ATLANTA REGIONAL MANAGED LANE SYSTEM PLAN

STATED PREFERENCES SURVEY

PREPARED FOR

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Atlanta Regional Managed Lane System Plan

Technical Memorandum 1B: Greater Atlanta Stated Preference Survey Documentation

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EXECUTIVE SUMMARY

This report describes the automobile and commercial vehicle stated preference survey that Resource Systems Group, Inc. (RSG) conducted in May and June 2007. HNTB contracted RSG to conduct the stated preference travel study as part of their work for the Georgia Department of Transportation (GDOT). GDOT is currently evaluating the addition of managed lanes and/or truck only toll (TOT)[1] lanes to sections of I-20, I-75, I-85 and the I-285 orbital highway around Atlanta

The purpose of the stated preference survey was to obtain detailed information that could be used to determine how sensitive travelers would be to the tolling and travel-time changes that would result from the addition of managed lanes or TOT lanes to the highways being studied. Estimates of travelers' toll price sensitivities are used to support estimates of highway traffic and toll revenue.

RSG developed and implemented a stated preference survey that gathered information from individuals who could use the proposed managed lanes or TOT lanes on the highways being studied. The survey collected data on current travel behavior, presented respondents with information about the proposed managed lanes or TOT lanes, and, with the use of stated preference experiments, collected information that can be used to estimate travelers' values of time and propensity to use managed toll lanes or TOT lanes under a range of possible future conditions.

Data collection took place in the greater Atlanta area in May and June 2007. Survey data were collected by intercepting residents at activity sites and through online completion by residents and employees of local businesses, organizations, and colleges in the greater Atlanta area. A total of 4,173 respondents completed the survey designed for auto users, while 413 respondents completed the commercial vehicle survey.

Statistical analysis and discrete choice model estimation were carried out using the stated preference survey data segmented by vehicle type, highway used, trip purpose and time of day (AM peak, PM peak and off-peak periods). The specification testing was completed using a conventional maximum likelihood procedure that estimated a set of coefficients for a multinomial logit model. More complex mixed multinomial logit models were then estimated to derive the distribution of values of time within each segment and allow diversion curves to be simulated.

Values of time for auto drivers estimated using the stated preference data were shown to vary by time of day, trip purpose, and within those segments, to vary by household income and trip distance. Commercial vehicle values of time were shown to vary by trip distance and vehicle size (number of axles). Mean values of time for autos (at average incomes and trip distances) varied from $7 to $15 per hours, while a 5 axle commercial vehicle making an average trip distance was found to have a value of time of $23 per hour.

[1] TOT means the managed lanes are reserved for trucks willing to pay a toll.

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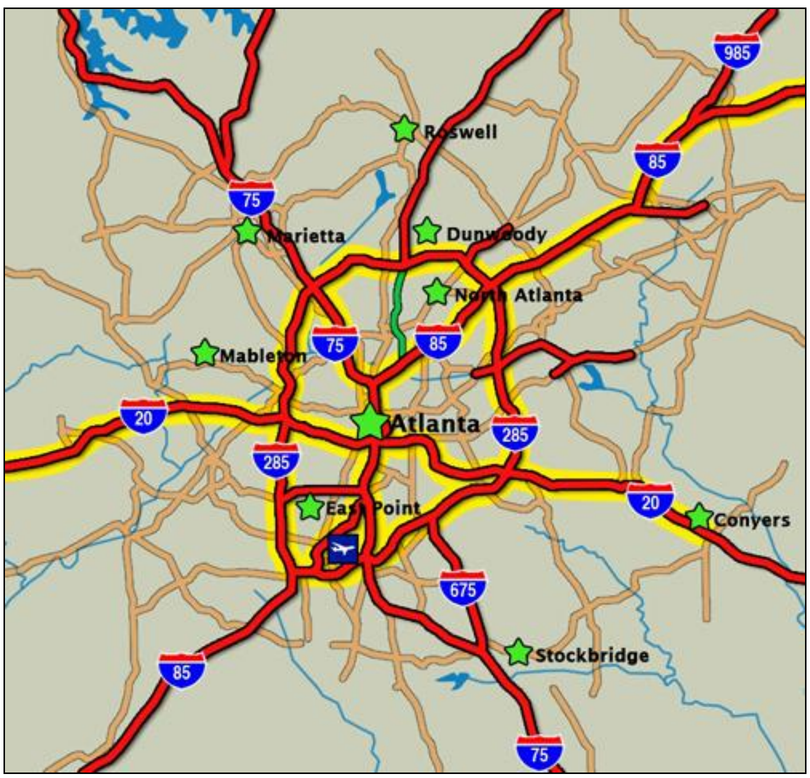
INTRODUCTION

This report describes the automobile and commercial vehicle stated preference survey that Resource Systems Group, Inc. (RSG) conducted in May and June 2007. HNTB contracted RSG to conduct the stated preference travel study as part of their work for the Georgia Department of Transportation (GDOT).

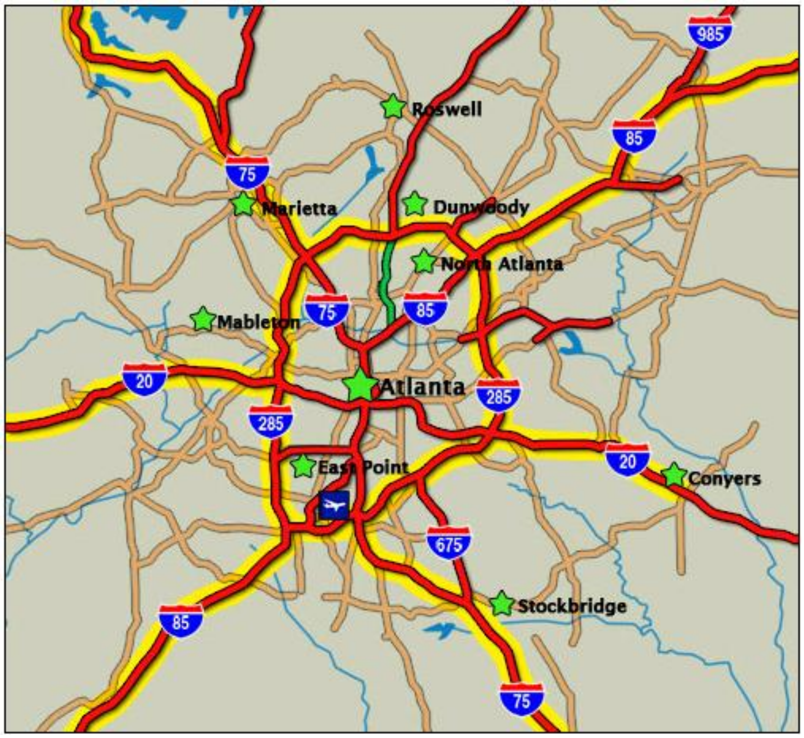
GDOT is currently evaluating the addition of managed lanes on the Interstate Highways throughout the Atlanta Metro Region. Several routes, including I-75 North, I-75 South, and SR 400 have been studied previously and stated preference survey conducted. Therefore, the focus of this effort is to investigate motorist's willingness to pay for premium transportation services in the *remaining* studied corridors (highlighted in yellow in Figure 1). However, data from all managed lane corridors will be examined and employed in this study.

Figure 1: Passenger Vehicle Stated Preference Survey Study Corridors



The commercial vehicle section of the survey evaluated the addition of truck only toll (TOT) lanes on the Study Routes. In order to accommodate as many commercial vehicle respondents as possible, the Study Routes for the commercial vehicle survey included I-75 north of I-285 and I-85 and I-75 south of I-285 (Figure 2 on the following page).

Figure 2: Commercial Vehicle Stated Preference Survey Study Corridors



The purpose of the stated preference survey was to obtain detailed information that could be used to determine how sensitive travelers would be to the tolling and travel-time changes that would result from the addition of managed lanes or TOT lanes to the Study Routes. Estimates of travelers' toll price sensitivities are used to support estimates of highway traffic and toll revenue.

RSG developed and implemented a stated preference survey that gathered information from individuals who could use the proposed managed lanes or TOT lanes on the Study Routes. The survey collected data on current travel behavior, presented respondents with information about the potential of managed lanes or TOT lanes, and, with the use of stated preference experiments, collected information that can be used to estimate travelers' values of time and propensity to use managed toll lanes or TOT lanes under a range of possible future conditions.

Data collection took place in the greater Atlanta area in May and June 2007. Survey data were collected by intercepting residents at activity sites and through online completion by residents and employees of local businesses, organizations, and colleges in the greater Atlanta area.

This report documents the survey approach, design, and administration; describes the characteristics of the automobile and commercial vehicle samples; and details the resulting choice models and simulated diversion curves derived using the choice models.

Survey Approach

The stated preference survey was designed and administered to identify the travel patterns and preferences of passenger vehicle and commercial vehicle travelers who could reasonably use managed lanes or TOT lanes in the greater Atlanta area.

The stated preference survey approach employed a computer-assisted self-interview (CASI) technique developed by RSG. The stated preference survey instrument was customized for each respondent by presenting questions and modifying wording based on respondents' previous answers. These dynamic survey features provide an accurate and efficient means of data collection and allow presentation of realistic future conditions that correspond with the respondents' reported experiences.

The customized, proprietary software was programmed for administration on laptop computers at a wide variety of activity sites in the greater Atlanta area, and for over the Internet via email distribution to targeted audiences. Travelers were intercepted at heavily trafficked shopping areas, public offices, universities, and local institutions. Additional data were collected by administering the survey online to employees of large area businesses and institutions, and to respondents intercepted in activity sites that were handed a postcard detailing instructions to complete the survey online.

Survey Questionnaire

Automobile and commercial vehicle respondents were screened to ensure that they would describe trips that could reasonably use the Study Routes in the greater Atlanta area. Respondents reported if they had made a weekday trip within the last week which was at least 15 minutes long and used or could have used any of the Study Routes: specifically, I-20 from Villa Rica east to Conyers, I-85 from Red Oak (SW intersection of I-285) to Braselton to the north, I-285, and highways I-20, I-75, and I-85 within the I-285 perimeter. These screening criteria, in combination with validation of respondents' origins and destinations, ensured that respondents focused on a trip that in the future could reasonably use the managed lanes or TOT lanes. Respondents were asked to keep the details of this trip in mind as they completed the questionnaire.

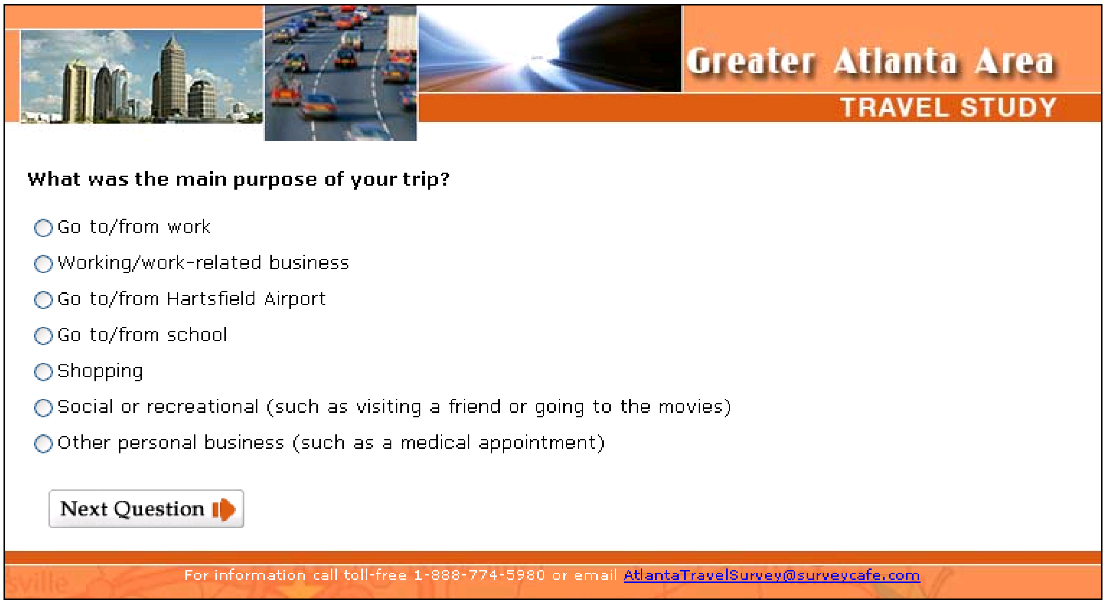
Automobile Survey Questionnaire

The automobile questionnaire consisted of four main parts: context questions that asked for details about the respondent's trip, a description of the managed lanes in the greater Atlanta area, stated preference questions that presented a managed lane alternative and a carpool alternative to the respondent's current route, and debrief and demographic questions. The text of the automobile questionnaire is included in Appendix A and example survey screens are included in Appendix J.

Context Questions

Having met the screening criteria, automobile respondents provided details about their most recent trip that was at least 15 minutes long that used or could have used any of the Study Routes. Respondents reported details of their trip including the roads traveled, type of vehicle used for the trip, trip purpose, day of week, time of day, total travel time, and trip frequency. Additionally, airport travelers provided the direction of their trip (to or from the airport) and if applicable, the purpose of their flight. Figure 3 shows an example screenshot from the trip description section of the survey.

Figure 3: Automobile Trip Purpose



The respondent was asked whether their trip began or ended at home so that the trip could be categorized as either home based or non-home based, which is important for segmentation purposes during data analysis. To identify the locations where their trip began and ended, respondents had the choice of entering street addresses or clicking on a map of the greater Atlanta area (Figure 4). Each respondent's origin and destination was geocoded to a latitude and longitude and assigned to a zone within a grid system created by RSG. The zones in this grid system are smaller than the Traffic Analysis Zones (TAZ) in the network model for the greater Atlanta area and therefore provide more accurate pinpointing of origin and destination locations. Each origin and destination latitude and longitude was also assigned to a TAZ from the network model for later analysis.

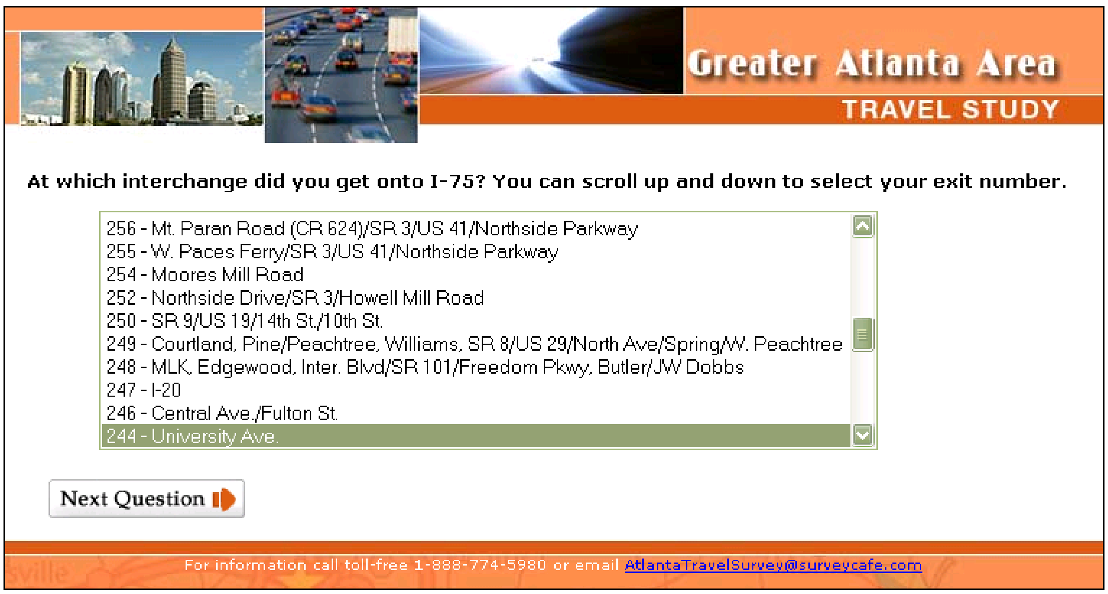
Figure 4: Greater Atlanta Map for Trip Origin and Destination Locations (Automobile Questionnaire)

In order to validate respondents' reported total travel times, a complete set of zone to zone travel times and distances (skim data) were calculated before survey administration. If the respondent's reported travel time was outside an acceptable range of variation around the travel time obtained from the skim data, below half of the estimated travel time or more than double the estimated travel time, the respondent was shown a warning asking him/her to verify that their reported travel time was correct.

The skim data were also used to estimate the proportion of travel time and distance occurring on interstate highways versus time and distance on other roads. The ratio of highway time to time on other roads obtained from the skim data was applied to the respondent's total travel time. For example, if skim data showed a 2:1 ratio for highway time versus time on other roads, and the respondent reported a 60 minute travel time, it was estimated that 40 minutes of the reported travel time was spent on highways. This information was used to construct the stated preference experiments later in the survey (see formulas below in Table 1). In this example, the respondent's "time to/from the study highway" would be 20 minutes, and the highway distance was calculated using the skim data.

Each respondent's geocoded origin and destination information were also used to estimate likely on- and off-ramps for the Study Routes (Figure 5). Since the Study Routes include many interchanges, the origin and destination information was used to identify the closest and therefore most likely entrance and exit ramps. Respondents were still able to choose any entrance and exit ramp on the highway, but the question answers were centered on the closest and most likely ramp to minimize the respondent's need to scroll through a long list of ramp names.

Figure 5: Automobile On-Ramp Selection



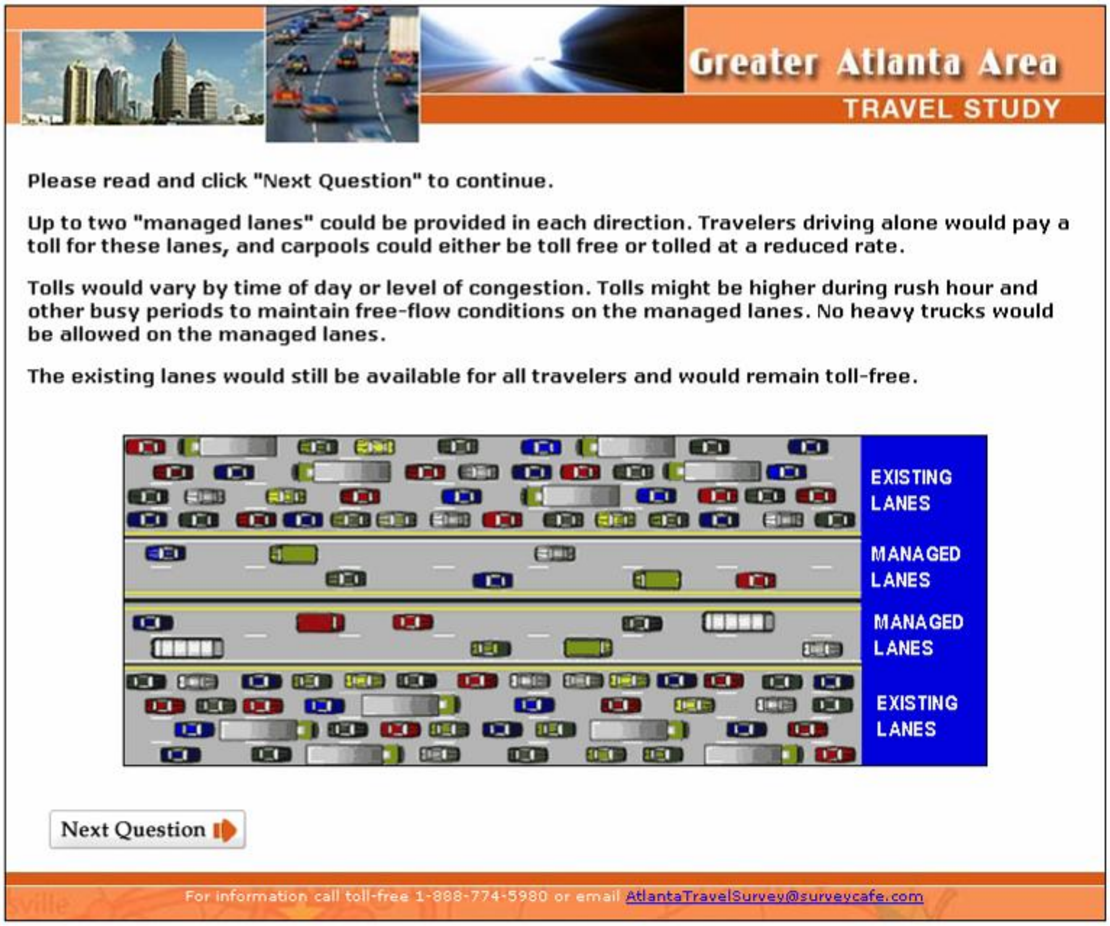
Respondents indicated whether they experienced delay due to heavy traffic during their trip and, if so, to identify the approximate amount of time delayed. Respondents were asked the number of occupants in their car, and, if they had carpooled, who had been in the car, why they had chosen to carpool, and if they had used an HOV lane on their trip.

To conclude the context questions, respondents reported if they had used the Georgia 400, the only toll road in the greater Atlanta area, and if they currently own an electronic toll collection (ETC) transponder.

Description of Proposed New Routes

Before beginning the stated preference trade-off questions, respondents were introduced to the proposed managed lanes that would be presented as alternatives to their current trip on the Study Routes. Respondents were provided with information on how the proposed managed lanes would function and were informed that the existing non-tolled lanes would still be available in the future (Figure 6).

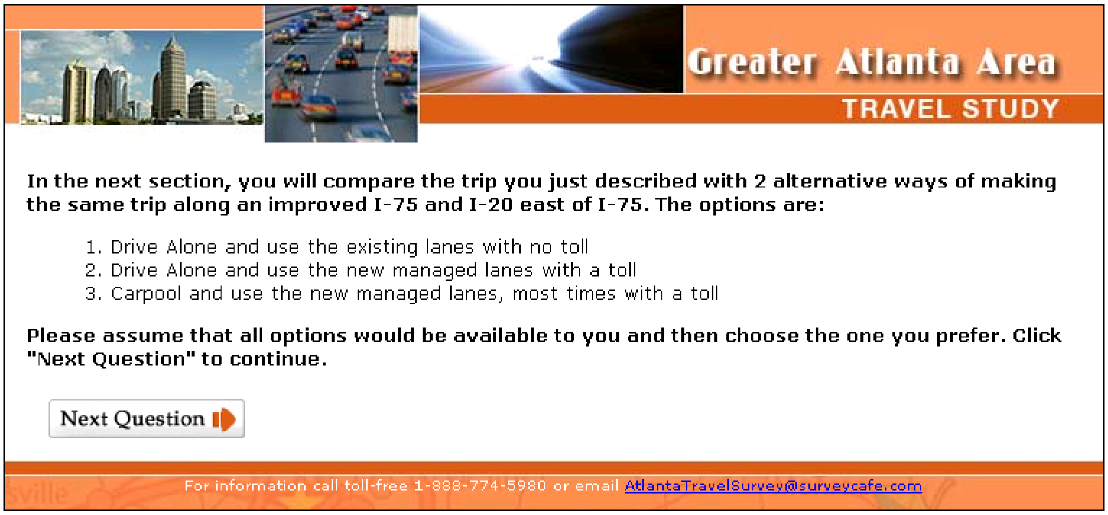
Figure 6: Description of Proposed Managed Lanes



Stated Preference Questions

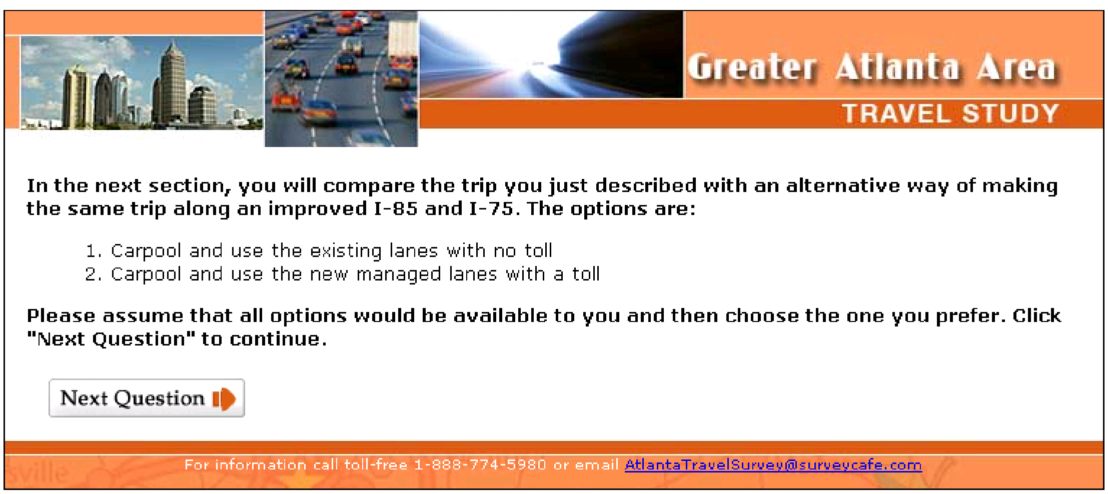
The survey presented each respondent with eight stated preference trade-off scenarios designed as choice experiments with three travel options. Each stated preference trade-off scenario listed three travel alternatives and asked respondents to make a choice based on the conditions presented. The three alternatives allowed respondents to select “existing lanes,” “new managed lanes: drive alone,” or “new managed lanes: carpool” (Figure 7 on the following page).

Figure 7: Automobile Stated Preference Alternatives Introduction



Respondents who were already traveling in a carpool of 3 or more passengers were shown two travel alternatives; "carpool in the existing lanes" and "carpool in the new managed lanes" (Figure 8).

Figure 8: Automobile Stated Preference Alternatives Introduction (Current Carpoolers with 3 or More Passengers)



Specific details of the three (or two) travel alternatives were customized based on each respondent's reported travel time, toll cost, and vehicle occupancy. Across all eight trade-off scenarios, the respondent was presented with different levels of each of these attributes and asked to "trade-off" between the choice alternatives (Figure 9 on the following page).

Figure 9: Automobile Stated Preference Scenario Example

The specific values assigned in each stated preference scenario were determined by using an orthogonal experimental design, which ensures that information is collected from respondents in a statistically efficient manner. This technique is commonly used in constructing experimental plans. The orthogonal design for this survey contained 32 experiments. For each respondent, eight experiments were selected and presented in random order. Each of the eight scenarios presented comprised one of the eight selected experiments.

Each experiment contained up to seven attributes, six of which were independently varied. The formulas used for calculating the levels for each attribute are included in the survey script in Appendix A. Table 1 on the following page shows the stated preference attributes and levels.

To ensure that the scenarios presented were believable to each respondent, the values for travel times and toll costs were based on characteristics of the recent trip reported by the respondent. Other inputs to the construction of the scenarios included the toll costs associated with the respondent's current trip, if any. By varying the travel times and tolls shown in each scenario, the respondent was faced with different time savings for different costs, allowing them to demonstrate their travel preferences across a range of values of time.

Managed lane travel time was based on the respondent's reported travel time, with time savings proportional to the distance the respondent would travel on the proposed managed lanes. Travel times were factored by multiplying the time on the study highway by a speed variation and adding the time to and from the study highway.

Table 1: Automobile Stated Preference Variables

Option	Attributes	Levels
Existing Lane	Travel time AET = Time to/from Study Highway SHD = Study Highway distance SHS = Study Highway speed SV = Speed variation = (.293 * SHS * -.002857)	AET + SHD / (SHS – 2 * SV) AET + SHD / (SHS – SV) AET + SHD / (SHS + SV) AET + SHD / (SHS + 2 * SV)
	Toll	Current toll as reported on toll question, if applicable
	Vehicle Occupancy	Current occupancy
New Managed Lanes: (not shown to current HOV 3+)	Travel time AET = Time to/from Study Highway SHD = Study Highway distance GPS = Existing Lane Option speed = (SHS + existing lane travel time level * SV)	Peak Travelers: AET + SHD / (GPS+ 25 mph) AET + SHD / (GPS+ 30 mph) AET + SHD / (GPS+ 35 mph) AET + SHD / (GPS+ 40 mph) *Note: Base speed outliers (extremely high or low) will be adjusted to produce a reasonable range of speeds Off-Peak Travelers: AET + SHD / (GPS+ 15 mph) AET + SHD / (GPS+ 20 mph) AET + SHD / (GPS+ 25 mph) AET + SHD / (GPS+ 30 mph)
	Toll SHD = Study Highway distance	*Note: If respondent currently pays a toll, that will be added to the toll for current route or both alternatives if applicable; minimum toll shown will be $0.25; maximum toll shown will be $25 Peak Travelers: SHD * 0.05/mile; SHD * 0.10/mile; SHD * 0.15/mile; SHD * 0.20/mile; SHD * 0.25/mile; SHD * 0.30/mile; SHD * 0.35/mile; SHD * 0.40/mile Off-Peak Travelers: SHD * 0.02/mile; SHD * 0.05/mile; SHD * 0.08/mile; SHD * 0.11/mile; SHD * 0.14/mile; SHD * 0.17/mile; SHD * 0.20/mile; SHD * 0.23/mile
	Vehicle Occupancy	Current Occupancy
New Managed Lanes: Carpool	Travel time	Same as new managed lanes: Current occupancy + 3 minutes per additional passenger (max 6 minutes)
	Toll	Free New managed lanes drive alone cost * .33 New managed lanes drive alone cost * .67 Same as new managed lanes drive alone cost
	Vehicle Occupancy	If drive alone: 2 people in carpool; 3 people in carpool If carpool: 3 people in carpool; 4 people in carpool

For the purpose of calculating travel time and toll costs, three miles was the minimum assumed distance in the managed lanes during peak travel, and four miles was the minimum used for trips during off-peak travel (Table 2). The maximum distance in the managed lanes was set to 50 miles. Minimum and maximum speed were dependant on time of day, with a peak minimum and maximum speed of 15 mph and 50 mph, respectively, and an off peak minimum and maximum speed of 35 mph and 65 mph, respectively.

Table 2: Minimum / Maximum Specifications for the Proposed Managed Lanes

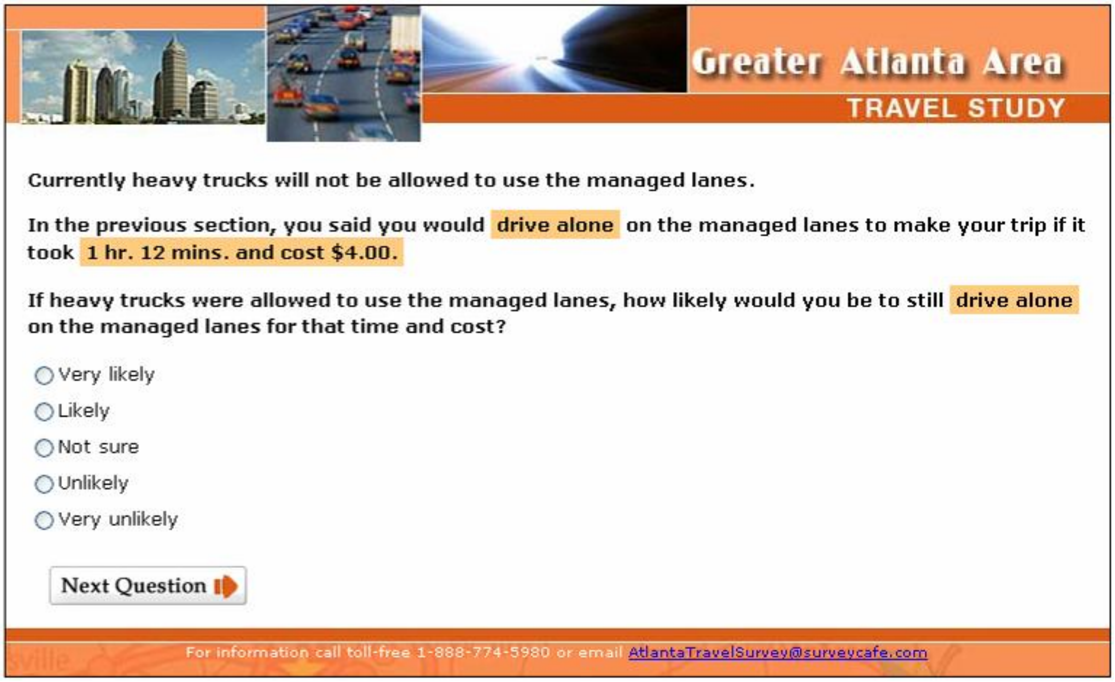
	Peak	Off Peak
Minimum Distance	3 miles	4 miles
Maximum Distance	50 miles	50 miles
Minimum Base Speed	15 mph	35 mph
Maximum Base Speed	50 mph	65 mph

Debrief and Demographic Questions

At the conclusion of the stated preference scenarios, respondents who did not choose the “managed lane” alternative in any of the eight trade-off scenarios were shown a debrief question asking them to provide the reason(s) why they never selected the managed lane option. For this question, as for the other debrief questions, the order of the answer options was randomized to minimize order bias. Similarly, respondents who did not choose the carpool managed lane alternative in any of the eight trade-off scenarios were asked to provide the reason(s) why they never selected the carpool option. Respondents who did choose a managed lane alternative in at least one of the eight trade-off scenarios were asked to provide the reason(s) why they had selected a managed lane option.

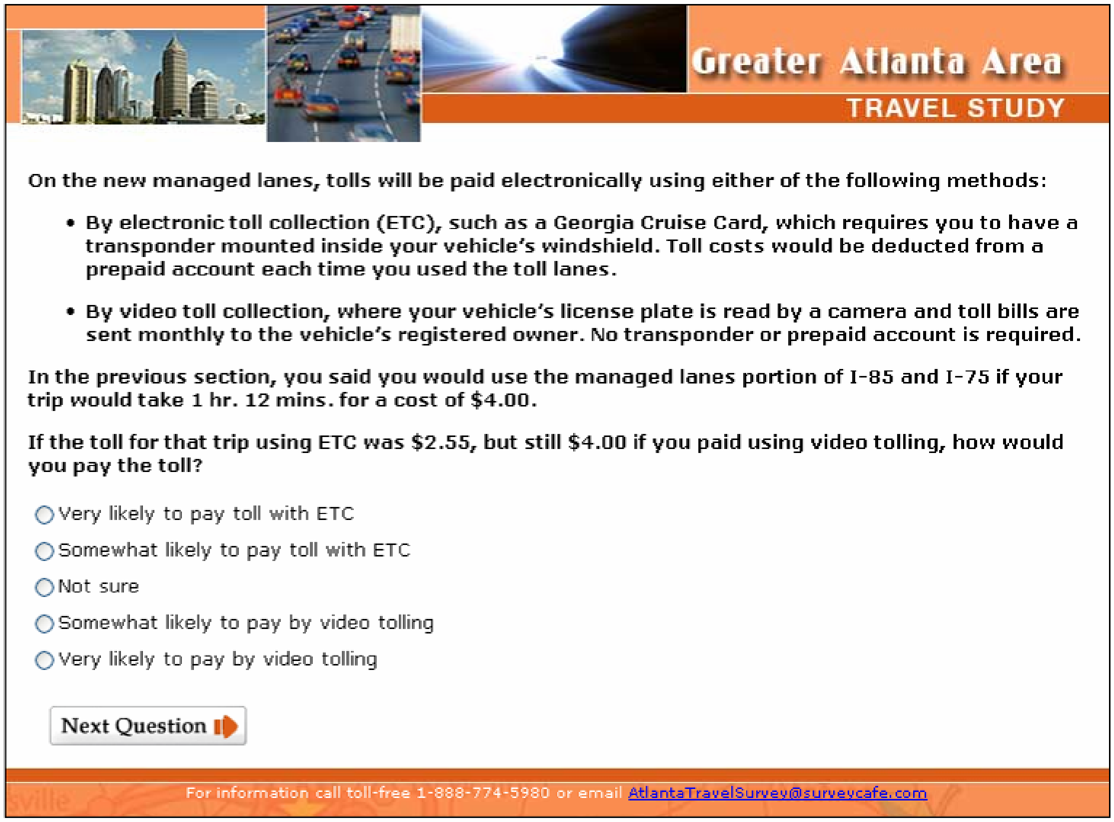
Respondents who selected at least one of the managed lanes alternatives were asked their likelihood of choosing to use the managed lane alternative with the same time and toll if heavy trucks were also allowed to use the managed lanes (Figure 10 on the following page).

Figure 10: Likelihood of Use of Managed Lanes with Heavy Trucks



Respondents who selected at least one managed lane alternative in the stated preference scenarios and who did not currently own a Georgia Cruise Car or another form of ETC transponder were asked their willingness to obtain an ETC transponder if the toll cost when paying with an ETC was discounted compared to paying the toll cost by video tolling. The ETC discount shown to the respondent was randomly selected to be 30%, 45%, or 60% over the amount the respondent had previously indicated they would pay in the stated preference section.

Figure 11: Likelihood of Obtaining ETC Transponder with Discount to Video Toll Collection (Automobile Questionnaire)


Greater Atlanta Area
TRAVEL STUDY

On the new managed lanes, tolls will be paid electronically using either of the following methods:

- By electronic toll collection (ETC), such as a Georgia Cruise Card, which requires you to have a transponder mounted inside your vehicle's windshield. Toll costs would be deducted from a prepaid account each time you used the toll lanes.
- By video toll collection, where your vehicle's license plate is read by a camera and toll bills are sent monthly to the vehicle's registered owner. No transponder or prepaid account is required.

In the previous section, you said you would use the managed lanes portion of I-85 and I-75 if your trip would take 1 hr. 12 mins. for a cost of $4.00.

If the toll for that trip using ETC was $2.55, but still $4.00 if you paid using video tolling, how would you pay the toll?

- Very likely to pay toll with ETC
- Somewhat likely to pay toll with ETC
- Not sure
- Somewhat likely to pay by video tolling
- Very likely to pay by video tolling

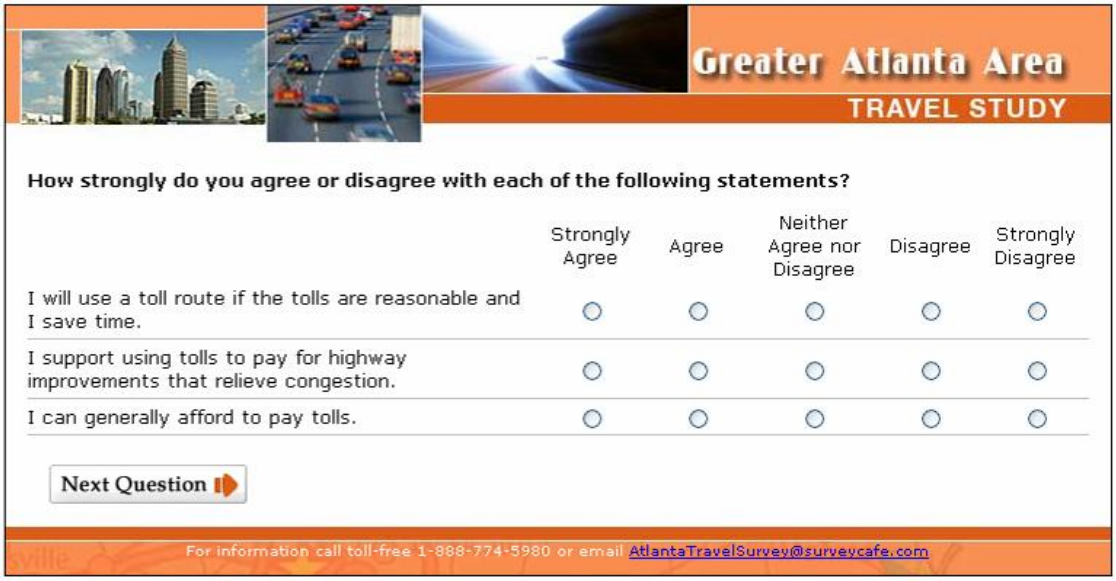
Next Question

For information call toll-free 1-888-774-5980 or email AtlantaTravelSurvey@surveycafe.com

The final set of debrief questions addressed respondents' opinions about the managed lanes. First respondents indicated their overall support or opposition for the project. Those who said they "strongly favor" or "somewhat favor" were shown a follow-up question asking their primary reason. Alternatively, those who said they "somewhat oppose" or "strongly oppose" were also shown a follow-up question asking their primary reason for opposing the concept.

Lastly, respondents were asked how strongly they agreed or disagreed with three statements related to their general opinion of toll related projects. The three statements, "I will use a toll route if the tolls are reasonable and I save time," "I support using tolls to pay for highway improvements that relieve congestion," and "I can generally afford to pay tolls" all help gauge a respondent's potential bias toward paying tolls or using toll roads.

Figure 12: General Toll Road Opinion Questions (Automobile Questionnaire)


Greater Atlanta Area
TRAVEL STUDY

How strongly do you agree or disagree with each of the following statements?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
I will use a toll route if the tolls are reasonable and I save time.	○	○	○	○	○
I support using tolls to pay for highway improvements that relieve congestion.	○	○	○	○	○
I can generally afford to pay tolls.	○	○	○	○	○

Next Question

For information call toll-free 1-888-774-5980 or email AtlantaTravelSurvey@surveycafe.com

To conclude the questionnaire, all respondents answered general demographic questions to allow comparison of the sample to the overall population in the greater Atlanta area that would be served by the proposed highway improvements. The demographic questions included resident/visitor status, county of residence, household size, number of household vehicles, gender, age, employment status, access to the Internet, point of Internet access, and annual household income.

At the conclusion of the demographic questions, respondents were given the opportunity to leave comments about the survey or about the proposed managed lanes. These responses are provided in Appendix L.

Commercial Vehicle Survey Questionnaire

Commercial vehicle respondents, like automobile respondents, reported if they had made a weekday trip within the last week which was at least 15 minutes long and used or could have used any of the Study Routes. The Study Routes included those used in the automobile survey, and also extended north from the I-285 perimeter on I-75 and south from the I-285 perimeter on I-75 and I-85.

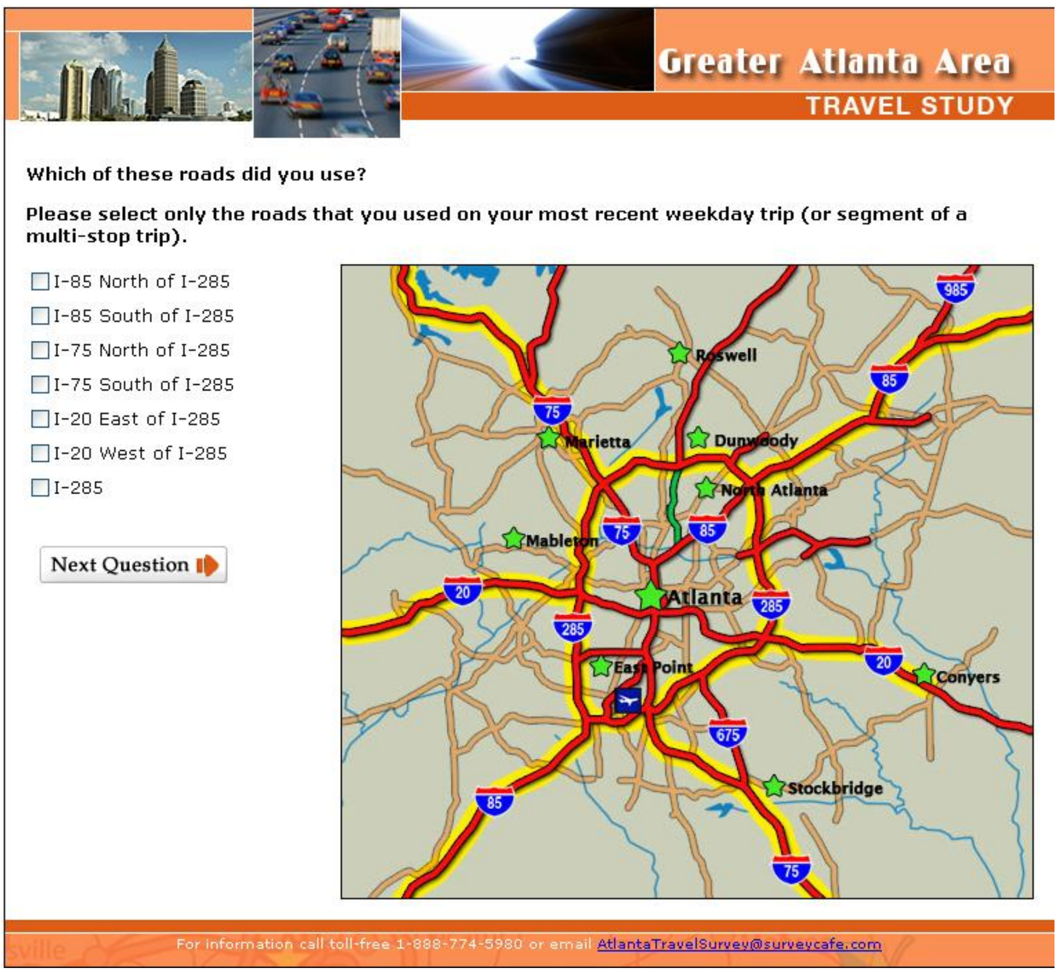
Given that commercial vehicles may make many stops during the course of a day, commercial vehicle respondents were specifically asked to describe their trip from one point to another with no stops in between, or a segment of a multi-stop trip (for example, the segment of their trip between the first stop and the second stop). These screening criteria, in combination with validation of respondents' origins and destinations, ensured that respondents focused on a trip that in the future could reasonably use the TOT lanes. Respondents were asked to keep the details of this trip in mind as they completed the questionnaire.

The commercial vehicle questionnaire consisted of four main parts: context questions that asked for details about the respondent's trip and role, a description of the TOT lanes in the greater Atlanta area, stated preference questions that presented a truck only lane alternative to their current route, and debrief and company questions. The text of the commercial vehicle questionnaire is included in Appendix B and example survey screens are included in Appendix K.

Context Questions

Having met the screening criteria, commercial vehicle respondents provided background information on their commercial vehicle company, their role as a driver, owner, manager, or dispatcher, and the routing decision maker at their company. Secondly, the respondent reported the details of their trip which could have used the TOT lanes in the future, including the roads used (Figure 13), vehicle type and cargo, trip purpose, day of week, time of day, total travel time, trip frequency, and approximate amount of time delayed.

Figure 13: Roads Used (Commercial Vehicle Questionnaire)

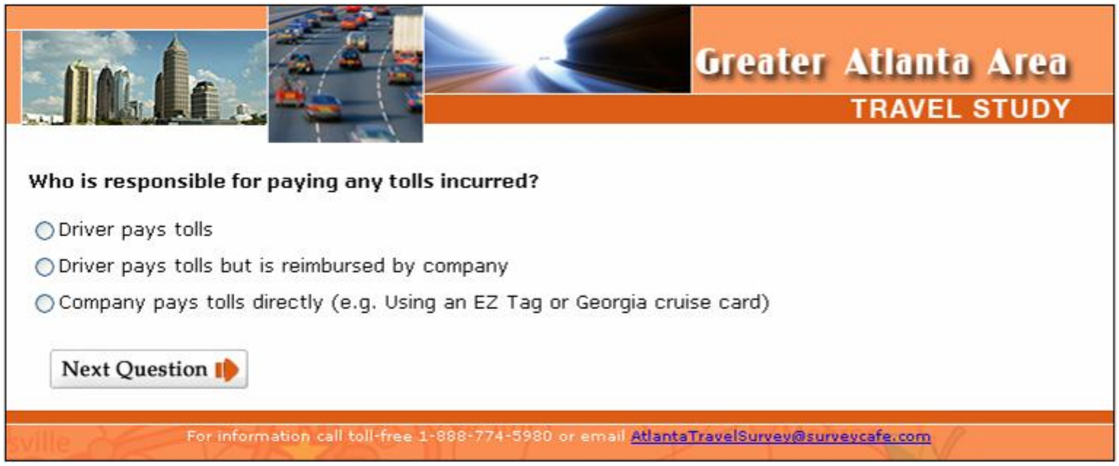


Commercial vehicle respondents were asked to identify the locations where their trip began and ended in similar way to automobile respondents. If the respondent elected to use a map to find the start or end of the trip, the map was loaded showing a larger area than in the automobile survey due to the longer trips that form a significant proportion of commercial vehicle travel (Figure 14). As with the automobile survey, the origin and destination information was geocoded, and, in combination with validated travel times, used later in the survey to build the stated preference experiments.

Figure 14: Region Map for Trip Origin and Destination Locations (Commercial Vehicle Questionnaire)

To conclude the context questions, commercial vehicle respondents reported if they had paid any tolls in Georgia on their trip, who was responsible for paying tolls, how their company charges customers for tolls, and if the driver currently owned an electronic toll collection (ETC) transponder such as a Georgia Cruise Card (Figure 15).

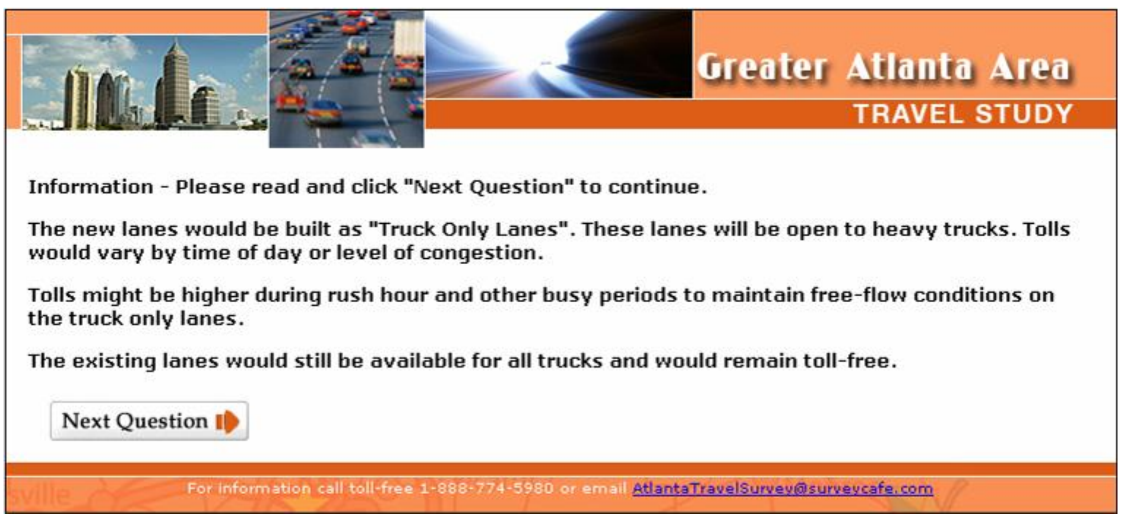
Figure 15: Commercial Vehicle Toll Responsibility



Description of Proposed New Routes

Before beginning the stated preference trade-off questions, commercial vehicle respondents were presented with introductory information and introduced to the proposed TOT lanes that would be presented as an alternative to their current trip on the Study Routes. Respondents were provided with information on how the proposed TOT lanes would function and were informed that the existing non-tolled lanes would still be available in the future (Figure 16).

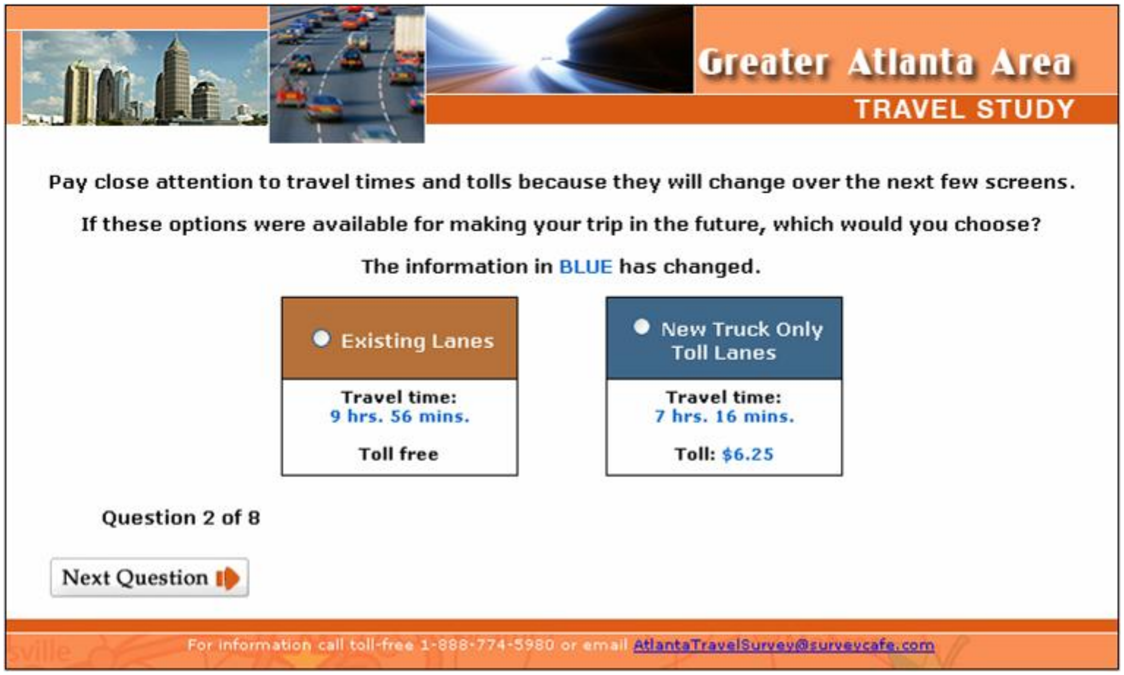
Figure 16: Description of Proposed Truck Only Toll Lanes



Stated Preference Questions

The survey presented each respondent with eight stated preference trade-off scenarios designed as choice experiments with two travel options. Each stated preference trade-off scenario listed two travel alternatives and asked commercial vehicle respondents to make a choice based on the conditions presented. The two alternatives allowed commercial vehicle respondents to select "existing lanes" or "new truck only toll lanes."

Figure 17: Commercial Vehicle Stated Preference Scenario Example



Specific details of the two alternatives were customized based on the reported travel time and toll cost. Across all eight trade-off scenarios, the commercial vehicle respondent was presented with different levels of each of these attributes and asked to "trade-off" among between the choice alternatives.

As with the automobile survey, the stated preference experiments were constructed using an orthogonal experimental design. Each experiment contained four attributes, three of which were independently varied. The formulas used for calculating the levels for each attribute are included in the survey script in Appendix B. Table 3 (on the following shows the stated preference attributes and levels.

TOT lane travel time was based on the respondent's reported travel time, with time savings proportional to the distance the respondent would travel on the proposed TOT lanes. Travel times were factored by multiplying the time on the study highway by a speed variation and adding the time to and from the study highway.

To ensure that the scenarios presented were believable to each respondent, the base values for travel times and toll costs were based on characteristics of the recent trip reported by the respondent. Other inputs to the construction of the scenarios included the toll costs associated with the respondent's current trip, if any. By varying the travel times and tolls shown in each scenario, the respondent was faced with different time savings for different costs, allowing them to demonstrate their travel preferences across a range of values of time.

Table 3: Commercial Vehicle Stated Preference Variables

Option	Attributes	Levels
Existing Lane	Travel time AET = Time to/from Study Highway SHD = Study Highway distance SHS = Study Highway speed SV = Speed variation = (.293 * SHS * -.002857)	AET + SHD / (SHS – 2 * SV) AET + SHD / (SHS – SV) AET + SHD / (SHS + SV) AET + SHD / (SHS + 2 * SV)
	Toll	Current toll as reported on toll question, if applicable
New Truck Only Toll Lanes	Travel time AET = Time to/from Study Highway SHD = Study Highway distance GPS = Existing Lane Option speed = (SHS + existing lane travel time level * SV)	Peak Travelers: AET + SHD / (GPS+ 25 mph) AET + SHD / (GPS+ 30 mph) AET + SHD / (GPS+ 35 mph) AET + SHD / (GPS+ 40 mph) *Note: Base speed outliers (extremely high or low) will be adjusted to produce a reasonable range of speeds Off-Peak Travelers: AET + SHD / (GPS+ 15 mph) AET + SHD / (GPS+ 20 mph) AET + SHD / (GPS+ 25 mph) AET + SHD / (GPS+ 30 mph)
	Toll SHD = Study Highway distance NA = Number of Axles/2	*Note: If respondent currently pays a toll, that will be added to the toll for current route or both alternatives if applicable Peak Travelers: SHD * 0.05/mile * NA SHD * 0.10/mile * NA SHD * 0.15/mile * NA SHD * 0.20/mile * NA SHD * 0.25/mile * NA SHD * 0.30/mile * NA SHD * 0.35/mile * NA SHD * 0.40/mile * NA Off-Peak Travelers: SHD * 0.02/mile * NA SHD * 0.05/mile * NA SHD * 0.08/mile * NA SHD * 0.11/mile * NA SHD * 0.14/mile * NA SHD * 0.17/mile * NA SHD * 0.20/mile * NA SHD * 0.23/mile * NA

For the purpose of calculating travel time and toll costs, three miles was the minimum assumed distance in the TOT lanes during peak travel, and four miles was the minimum used for trips during off-peak travel (Table 4 on the following page). The maximum distance in the TOT lanes was set to 50 miles. Minimum and maximum speed were dependant on time of day, with a peak minimum and maximum speed of 15 mph and 50 mph, respectively, and an off peak minimum and maximum speed of 35 mph and 65 mph, respectively.

Table 4: Minimum / Maximum Specifications for the Proposed Truck Only Toll Lanes

	Peak	Off Peak
Minimum Distance	3 miles	4 miles
Maximum Distance	50 miles	50 miles
Minimum Base Speed	15 mph	35 mph
Maximum Base Speed	50 mph	65 mph

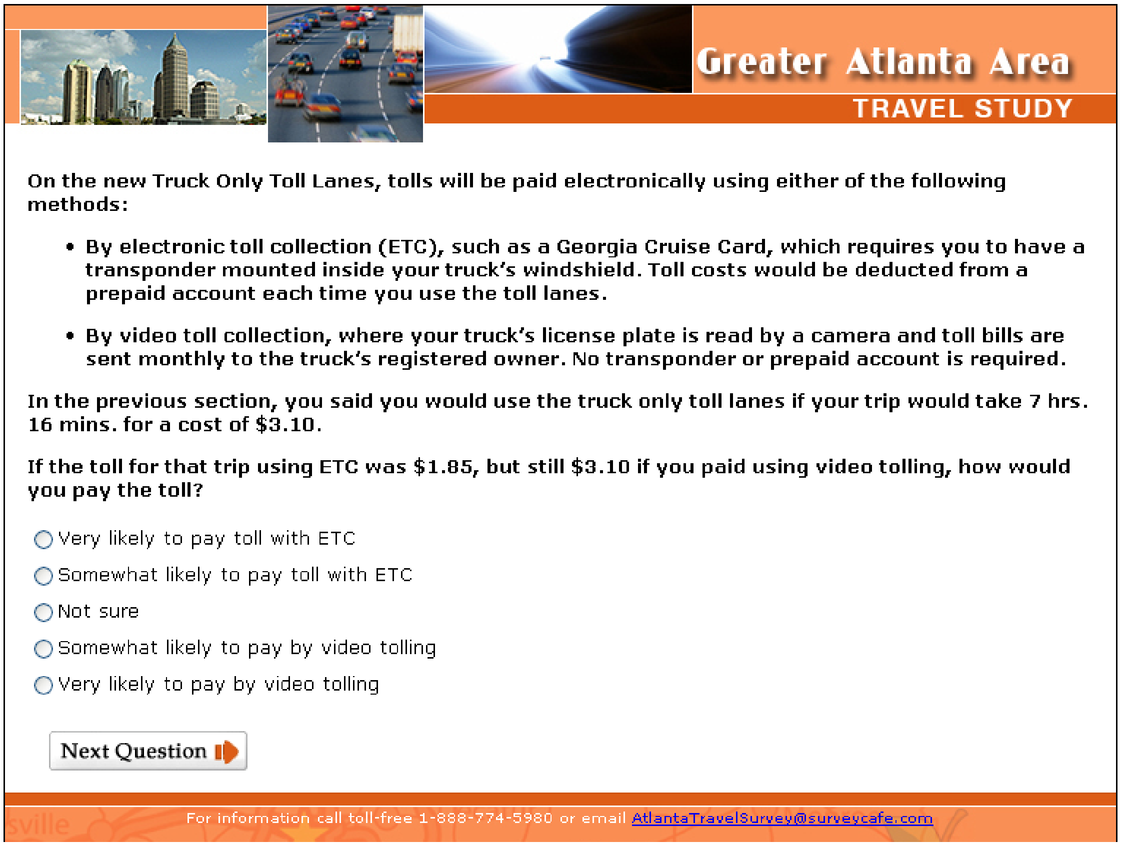
Debrief and Commercial Vehicle Background Questions

At the conclusion of the stated preference scenarios, respondents who did not choose the "new truck only toll lane" alternative in any of the eight trade-off scenarios were shown a debrief question asking them to provide the reason(s) why they never selected the TOT lane option. For this question, as for other debrief questions, the order of the answer options was randomized to minimize order bias.

Commercial vehicle respondents who chose a TOT lane alternative in any of the eight trade-off scenarios provided the reason(s) why they had selected the TOT option. These respondents were also asked their likelihood of choosing to use the TOT alternative with the same time and toll if automobiles were also allowed to use the truck only lanes.

Respondents who selected at least one TOT lane alternative in the stated preference scenarios and who did not currently own a Georgia Cruise Car or another form of ETC transponder were asked their willingness to obtain an ETC transponder if the toll cost when paying with an ETC was discounted compared to paying the toll cost by video tolling. The ETC discount shown to the respondent was randomly selected to be 30%, 45%, or 60% over the amount the commercial vehicle respondent had previously indicated they would pay in the stated preference section (Figure 18 on the following page).

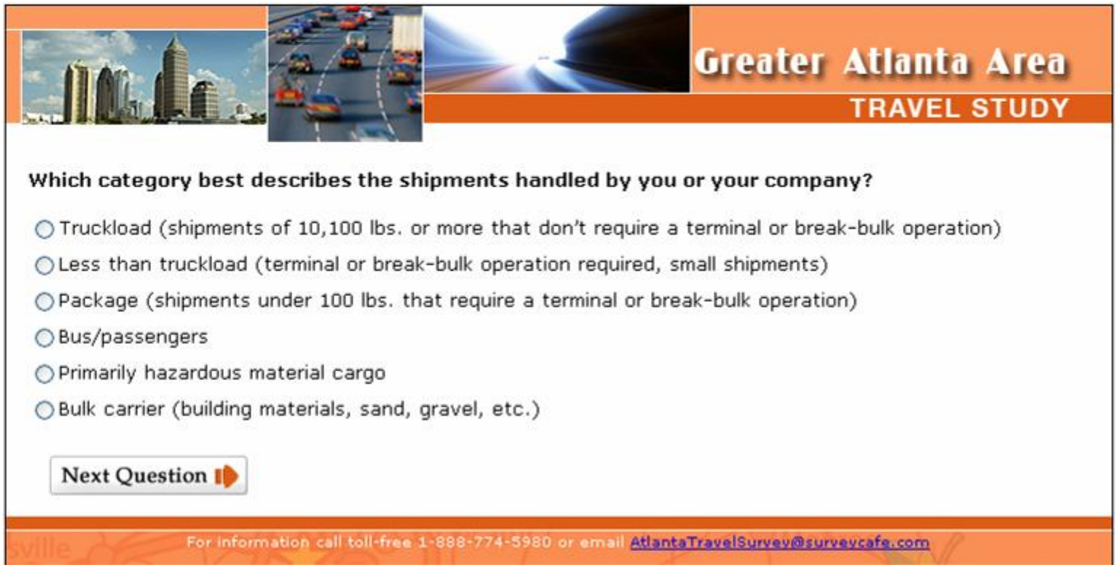
Figure 18: Likelihood of Obtaining ETC Transponder with Discount to Video Toll Collection (Commercial Vehicle Questionnaire)



The final set of debrief questions addressed respondents' opinions about the TOT lanes. First respondents indicated their overall support or opposition for the project. Those who said they "strongly favor" or "somewhat favor" the project were shown a follow-up question asking their primary reason for favoring the project. Alternatively, those who said they "somewhat oppose" or "strongly oppose" the project were also shown a follow-up question asking their primary reason for opposing the project.

To conclude the questionnaire, commercial vehicle respondents answered general background and demographic questions. The commercial vehicle background questions included location of the company headquarters, total number and type of company vehicles, number of company vehicles that use the Study Routes, the average trip length, the type goods typically carried, type of delivery schedule (fixed or flexible), the timeframe structure (penalty or incentive), and the category of shipments (Figure 19 on the following page).

Figure 19: Commercial Vehicle Shipment Categories



At the conclusion of the commercial vehicle background questions, respondents were given the opportunity to leave comments about the survey or about the proposed TOT lanes. These responses are provided in Appendix M.

Survey Administration

Data collection was conducted in May and June of 2007. Automobile and commercial vehicle travelers who made a weekday trip of 15 minutes or more that used or could have used any of the Study Routes were intercepted at various activity sites in the greater Atlanta area. Emphasis was placed on selecting sites that were close to the Study Routes with a high amount of pedestrian traffic. Automobile and commercial vehicle respondents were also able to complete the survey online.

Automobile Administration

The computer-based survey was administered in two phases:

1. Laptop-based administration of the survey to respondents intercepted at activity sites in the greater Atlanta area.

2. Online administration of the survey to employees of greater Atlanta businesses, via postcards handed out to respondents at activity sites, and through online sampling of residents of the greater Atlanta area.

A total of 4,173 respondents completed the survey, 1,812 of whom completed the survey at intercept sites and 2,361 of whom completed the survey by taking it online.

Administration at Activity Sites

A total of 1,812 respondents completed the survey questionnaire at activity sites. The survey questionnaire was administered at activity sites in the greater Atlanta area over a 30 day period from Thursday, 17 May 2007, to Friday, 15 June 2007 (Table 5).

Table 5: Automobile Field Intercept Date, Location, & Number of Respondents

			Date and Location	**17 May** Greenbriar Mall DDS Atlanta GSU	**18 May** Greenbriar Mall DDS Atlanta GSU	**19 May** Greenbriar Mall DDS Atlanta Stonecrest Mall
			Number of Respondents	**103**	**94**	**93**
20 May Greenbriar Mall Stonecrest Mall Northlake Mall	**21 May** Cumberland Mall GSU Georgia Tech	**22 May** Georgia Tech Cumberland Mall DDS Norcross	**23 May** Georgia Tech Cumberland Mall DDS Norcross	**24 May** Cumberland Mall DDS Norcross DDS Decatur	**25 May** Cumberland Mall Northlake Mall CNN Building	**26 May** Arbor Place Mall Northlake Mall CNN Building
72	**89**	**52**	**54**	**58**	**47**	**23**
27 May Arbor Place Mall Stonecrest Mall	**28 May** Arbor Place Mall Stonecrest Mall CNN Building	**29 May** Lenox Sq. Mall CNN Building Perimeter Mall	**30 May** DDS Union City Lenox Sq. Mall DDS Conyers Mall of Georgia	**31 May** DDS Union City Lenox Sq. Mall DDS Conyers	**1 June** Northlake Mall Lenox Sq. Mall DDS Forest Park	**2 June** Northlake Mall Lenox Sq. Mall Atlantic Station
32	**50**	**60**	**128**	**58**	**79**	**77**
3 June Stonecrest Mall Phipps Plaza Atlantic Station	**4 June** Stonecrest Mall Phipps Plaza Atlantic Station Bank of America	**5 June** Stonecrest Mall Bank of America Lenox Sq. Mall	**6 June** Stonecrest Mall Atl. Underground Lenox Sq. Mall	**7 June** Stonecrest Mall Atl. Underground GA Perimeter Atlanta Braves	**8 June** Stonecrest Mall Atl. Underground Atlantic Station	**9 June** Atl. Underground
64	**76**	**44**	**82**	**121**	**42**	**39**
10 June Off-Day	**11 June** Atlantic Station Atl. Underground	**12 June** Atlantic Station	**13 June** Atlantic Station	**14 June** Atlantic Station GSU	**15 June** Atlantic Station GA Perimeter	
0	**54**	**21**	**33**	**37**	**30**	

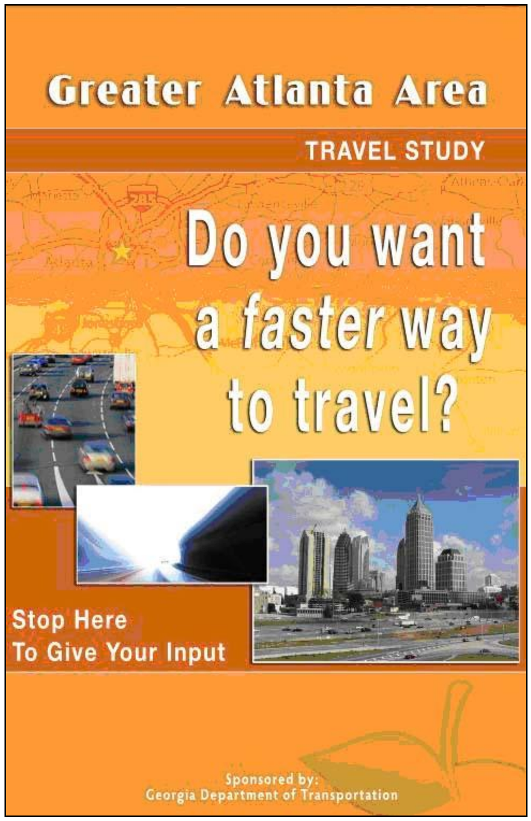
Activity sites with high pedestrian traffic and high incidence of people likely to meet the screening criteria were selected. Sites were chosen that would likely allow a good cross section of the population to be intercepted in terms of both trip purposes and demographics. Sites included Georgia Department of Driver Services (DDS), shopping centers and malls, colleges and universities, office buildings, and sports events.

Table 6: Automobile Survey Intercept Locations

Intercept Site	City	Venue Type
Arbor Place Mall	Douglasville	Shopping Center
Atlanta Braves (Turner Field)	Atlanta	Sporting Event
Atlanta Underground	Atlanta	Shopping Center
Atlantic Station	Atlanta	Shopping Center
Bank of America	Atlanta	Office Building
CNN Center	Atlanta	Office Building/Tourism
Cumberland Mall	Atlanta	Shopping Center
DDS – Atlanta Branch	Atlanta	State Office
DDS – Conyers Branch	Conyers	State Office
DDS – Decatur Branch	Decatur	State Office
DDS – Forest Park Branch	Forest Park	State Office
DDS – Norcross Branch	Norcross	State Office
DDS – Union City Branch	Union City	State Office
Georgia Institute of Technology	Atlanta	University
Georgia Perimeter College	Clarkston	University
Georgia State University (GSU)	Atlanta	University
Greenbriar Mall	Atlanta	Shopping Center
Lenox Square Mall	Atlanta	Shopping Center
Mall at Stonecrest	Lithonia	Shopping Center
Mall of Georgia	Buford	Shopping Center
Northlake Mall	Atlanta	Shopping Center
Perimeter Mall	Atlanta	Shopping Center
Phipps Plaza	Atlanta	Shopping Center

The intercept survey administration setup consisted of 20 laptop computer interview stations distributed across three or four locations each day. A poster mounted on an easel was positioned near the interview stations to help attract respondents (Figure 20 on the following page). Each survey site was staffed by three attendants who were responsible for approaching and screening potential respondents, escorting the respondents to interview stations, and assisting respondents who had questions or required computer assistance.

Figure 20: Greater Atlanta Area Travel Study Survey Poster



When taking the survey, respondents sat in front of a laptop computer and used a mouse or the keyboard to record their answers and navigate through the questionnaire. Most respondents completed the questionnaire in 10 to 15 minutes. Data for each individual were automatically saved to the computer for later analysis. Respondents were generally enthusiastic about participating in the survey and seemed to enjoy the questionnaire's interactive technology.

Internet-Based Survey Administration

A total of 2,361 respondents completed the survey online (Table 7 on the following page). Respondents were invited in one of three ways to take the Internet-based survey.

1. By receiving an invitation postcard with a unique password when walking by an intercept site.

2. By receiving an email with an invitation and survey link from their employer.

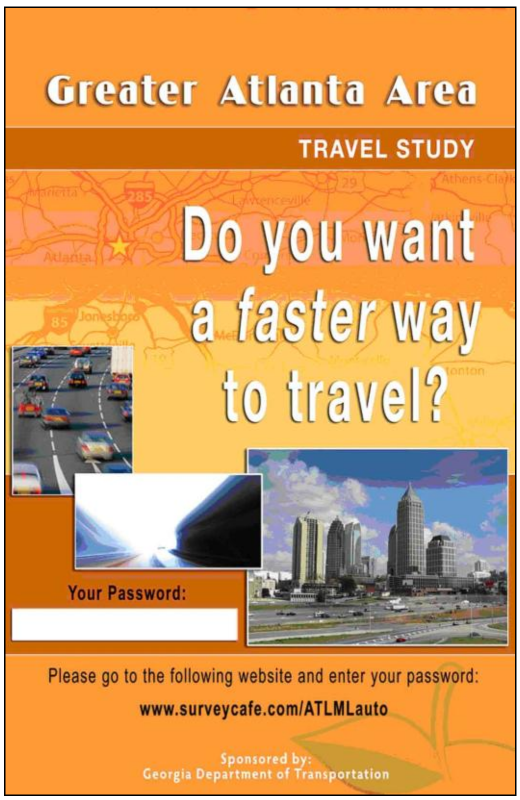
3. By receiving an email with an invitation and a unique password from a third party survey sample company.

Table 7: Internet-Based Automobile Survey Participation

Site	City	Number of Respondents
Business Recruitment	Atlanta	1,278
Online Sample Provider (SSI)	Greater Atlanta	966
Postcard Handout at Field Sites	Greater Atlanta	117
Total		**2,361**

One-hundred seventeen respondents completed the survey after receiving a postcard with the survey link and a password. These respondents were intercepted at activity sites, but indicated they were unable to participate at that particular time. Because they were interested in participating at a different time, these respondents were provided with the postcard with a unique password and the link to completing the survey online.

Figure 21: Greater Atlanta Area Travel Study Survey Postcard



The second method for completing the survey online was by inviting employees of local businesses and organizations. Many large corporations located in the greater Atlanta area were contacted and asked to distribute an email with an Internet link inviting their employees to complete the survey online. Of the 37 businesses in the greater Atlanta area that were contacted, six agreed to participate. Online participation by these respondents provided input from a sample mainly comprised of peak-period work travelers who are slightly older and have higher average annual household incomes than respondents recruited at activity sites.

The final type of Internet-based data collection was by direct email to greater Atlanta area residents inviting them to participate in the survey. Beginning June 29th, respondents were recruited via email from Survey Sampling International (SSI), an online sample provider. Overall, 966 respondents completed the survey on the Internet after being invited by SSI.

A link and unique password to the survey hosted by RSG on its SurveyCafe.com website was provided to participants. Respondents were provided with instructions for filling out the questionnaire, along with an email and a toll-free telephone number to request assistance if necessary. The Internet-based survey was exactly the same as the survey administered at activity sites in the greater Atlanta area.

Commercial Vehicle Administration

The computer-based survey about commercial vehicle travel was administered in two phases:

1. Laptop-based administration of the survey to respondents intercepted at activity sites in the greater Atlanta area.

2. Online administration of the survey to dispatchers and managers of companies in the greater Atlanta area that operate commercial vehicles.

A total of 413 respondents completed the commercial vehicle survey, 412 of whom completed the survey at intercept sites, while only 1 respondent completed the survey by taking it online.

Administration at Activity Sites

Data collection was conducted concurrently with the automobile survey over a fourteen day period from Thursday, 31 May to Friday, 15 June 2007 (Table 8 on the following page).

Table 8: Commercial Vehicle Field Intercept Date, Location, & Number of Respondents (31 May to 15 June 2007)

			Date and Location	**31 May** Petro Shopping	**1 June** Petro Shopping	**2 June** Petro Shopping
			Number of Respondents	**24**	**25**	**39**
3 June Petro Shopping	**4 June** Petro Shopping	**5 June** Travel Center	**6 June** Travel Center	**7 June** Travel Center	**8 June** Petro Shopping	**9 June** Off-Day
24	**26**	**51**	**49**	**35**	**22**	**0**
10 June Off-Day	**11 June** Quik Trip	**12 June** Quik Trip	**13 June** Quik Trip	**14 June** Quik Trip	**15 June** Quik Trip	
0	**19**	**28**	**25**	**24**	**21**	

The survey was administered at three truck stops along the Study Routes with high commercial vehicle traffic (Table 9).

Table 9: Commercial Vehicle Survey Intercept Locations

Site	City (Location)	Venue Type	Number of Respondents
Petro Shopping Center	Atlanta (off of I-285, west)	Truck Stop	160
Travel Center of America	Conley (off of I-285, south)	Truck Stop	135
Quik Trip #777	Atlanta (off of I-20, west)	Truck Stop	117
Total			**412**

The intercept survey administration setup for the commercial vehicle survey was identical to that used for the automobile survey (described previously). It consisted of 4-5 laptop computer interview stations at a site, and was staffed by three attendants.

Internet-Based Survey Administration

Drivers, dispatchers, and others involved in making truck routing or toll payment decisions at companies operating commercial vehicles were invited to complete the survey via the Internet. Online recruitment proved challenging and although 31 commercial vehicle organizations and companies were contacted, only one company agreed to send the invitation to their employees. This resulted in one completed survey. Of the 30 companies that were invited to participate in the online survey, five declined and 25 were never able to approve the survey or simply did not respond to phone calls.

Survey Results

The survey was designed to produce a generally representative sample of travelers in the greater Atlanta area. It is important to sample a sufficient range of travelers and trip types to support the statistical estimation of coefficients of a choice model. By collecting data from a range of traveler and trip types, it is possible to identify the ways in which different characteristics affect mode choice behavior. These differences can then be reflected in the structure and coefficients of the resulting choice model. The survey sample that supports choice model estimation does not need to be perfectly population proportional as long as: (a) any behavioral differences are properly represented in the model and (b) the model is applied for forecasting using appropriate population proportions and/or sample weights.

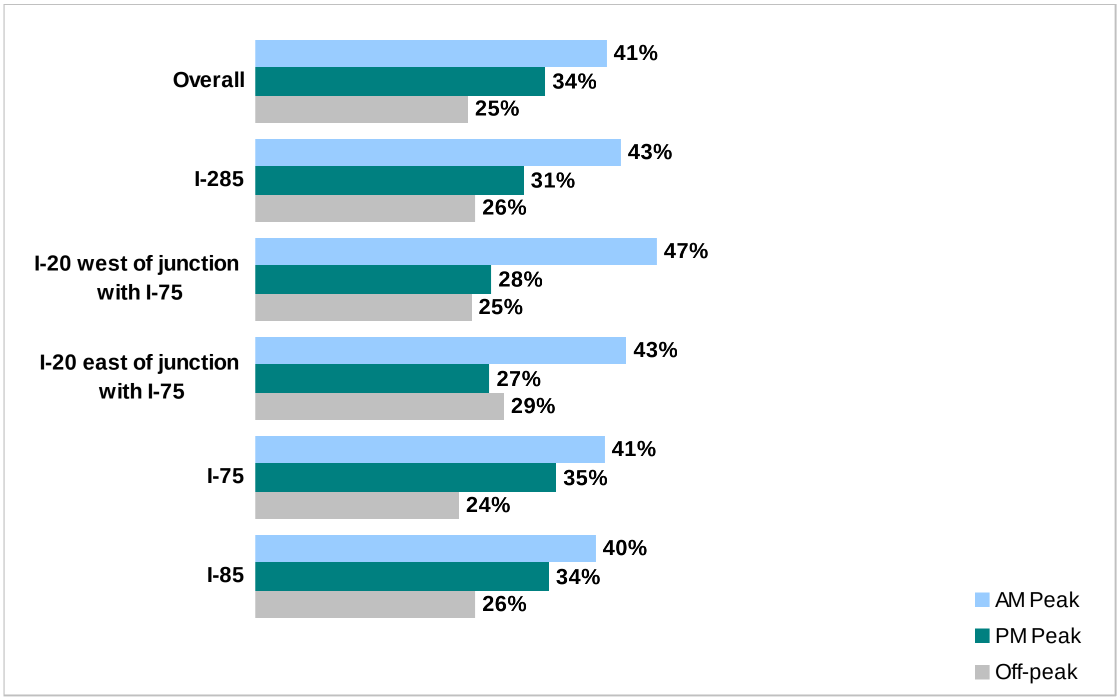
Automobile Results

A total of 4,173 respondents completed the survey. The descriptive analysis of the data presented in this section of the report is based on these responses and is provided in four sections: trip characteristics, reasons for choices made in the stated preference section, opinions of the project, and respondent demographics. Tabulations of survey questions by Study Route are shown in Appendix C, tabulations by time period are shown in Appendix D, and tabulations by trip purpose are shown in Appendix E. Model estimation of each trip purpose and time period segment by each corridor is shown in the Model Results section on the following page.

Trip Characteristics

To begin the survey, respondents selected which of the five Study Routes they had used most recently on a trip of 15 or more minutes during the AM peak, PM peak, or off-peak period. Respondents could choose more than one of the Study Routes and are included in the total for each route selected. Trips were distributed by time period as follows in Figure 22.

Figure 22: Study Routes Used by Time Period



Trips were distributed by corridor and purpose in Table 10. Overall, slightly more than half (51%) of all trips were commute trips to or from work. Social or recreational trips were second with 15% of all trips.

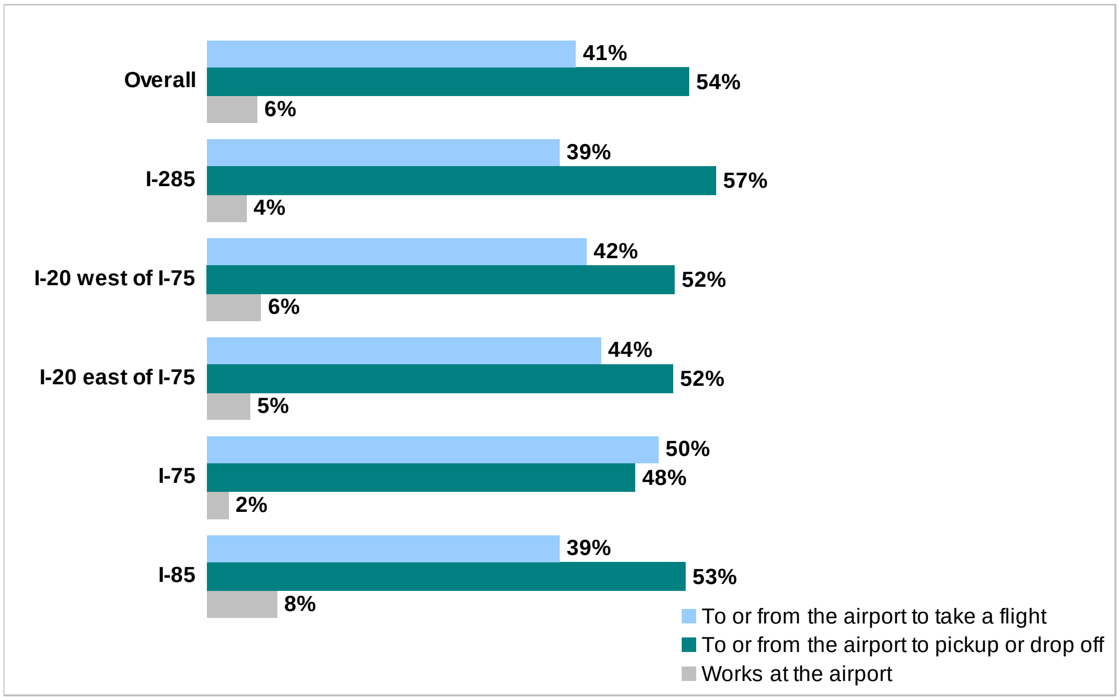
Table 10: Study Routes Used by Trip Purpose

Trip Purpose	I-85	I-75	I-20 east of junction with I-75	I-20 west of junction with I-75	I-285	Overall
Go to/from work	48%	51%	43%	49%	46%	51%
Work-related business	13%	12%	16%	14%	13%	12%
Go to/from Hartsfield Airport	4%	4%	2%	2%	4%	4%
Go to/from school	5%	5%	6%	5%	5%	5%
Shopping	5%	4%	4%	4%	3%	4%
Social or recreational	16%	15%	17%	17%	17%	15%
Other personal business	9%	9%	11%	10%	11%	10%
Total Number of Respondents	**1891**	**1660**	**761**	**591**	**1687**	**4173**

Note: Respondents could select more than one Study Route.

The 144 respondents who reported that they made their trip to go to or from Hartsfield Airport answered additional questions about their trip. Most airport trips used I-85 (56%), I-285 (52%), or I-75 (42%). Only 13% and 8% of airport trips used I-20 east of the junction with I-75 and I-20 west of the junction with I-75 respectively. Regardless of route used, trips to the airport were fairly evenly split between arriving from or taking a flight and dropping off or picking someone up from a flight (Figure 23 on the following page). Only 6% of respondents who reported a trip to Hartsfield Airport worked at the airport. Of the respondents arriving from or departing on a flight at Hartsfield Airport, 60% were flying for business reasons and 40% were taking a flight for non-business reasons.

Figure 23: Airport Trip Purpose by Study Routes



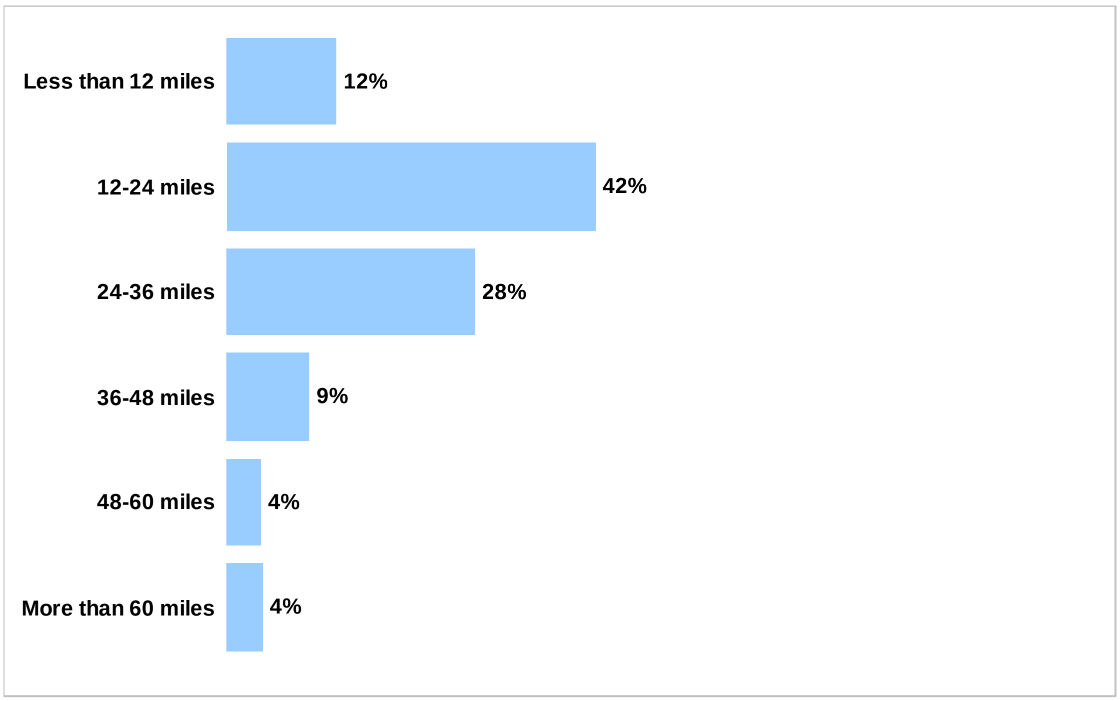
The shortest reported trip was less than 3 miles, while the longest was 140 miles. Respondent's total trip distances were distributed as shown in Figure 24 (on the following page) and are distributed by route in Table 11.

Table 11: Study Routes Used by Total Trip Distance

Trip Distance	I-85	I-75	I-20 east of junction with I-75	I-20 west of junction with I-75	I-285	Overall
Less than 12 miles	13%	11%	13%	11%	12%	12%
12–24 miles	38%	42%	41%	41%	43%	42%
24–36 miles	30%	28%	27%	28%	26%	28%
36–48 miles	11%	9%	11%	11%	11%	9%
48–60 miles	4%	5%	4%	4%	4%	4%
More than 60 miles	5%	5%	4%	6%	5%	4%
Total Number of Respondents	**1891**	**1660**	**761**	**591**	**1687**	**4173**

Note: Respondents could select more than one Study Route.

Figure 24: Total Trip Distance

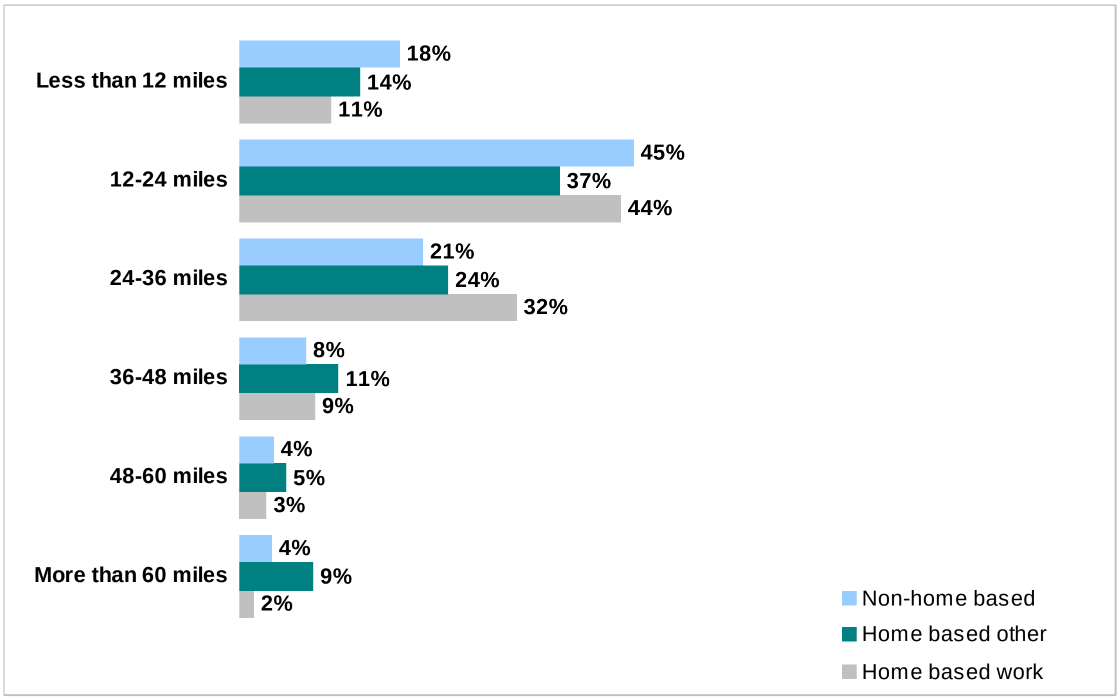


Overall, 44% of home-based work trips, 37% of home-based other trips, and 45% of non-home based trips were a distance of 12 to 24 miles long. Similarly, 32% of home-based work trips, 24% of home-based other, and 21% of non-home based trips were 24 to 36 miles long. Across trip purpose, distance distributions varied more than across Study Routes (Table 12).

Table 12: Total Trip Distance by Trip Purpose

Trip Distance	Go to/from work	Work-related business	Go to/from Hartsfield Airport	Go to/from school	Shopping	Social or recreation	Other personal business
Less than 12 miles	11%	14%	9%	14%	27%	12%	17%
12–24 miles	46%	36%	28%	47%	39%	36%	38%
24–36 miles	32%	29%	40%	25%	18%	20%	25%
36–48 miles	8%	10%	15%	9%	12%	12%	8%
48–60 miles	2%	6%	4%	3%	2%	8%	5%
More than 60 miles	1%	5%	4%	2%	2%	12%	8%
Total Number of Respondents	**2113**	**485**	**144**	**216**	**178**	**637**	**400**

Figure 25: Total Trip Distance by Automobile Segment



All respondents provided their entrance and exit ramps. Below are the most frequently cited entrance and exit ramp combinations by route. Respondents who indicated that they traveled more than one route are included in each route that they traveled.

Table 13: I-85 Ten Most Frequent Entrance and Exit Ramps

Entrance Ramp	Trips	Percent
Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree	218	12%
Almon Rd. (CR 46)	68	4%
SR 9/US 19/14th St./10th St.	51	3%
I-85 to I-285 Bypass	47	2%
MLK, Edgewood, Inter. Blvd/SR 101/Freedom Pkwy, Butler/JW Dobbs	47	2%
I-85 NB/SB to I-285 EB/WB	46	2%
SR 140/Jimmy Carter Blvd.	46	2%
SR 42/N. Druid Hills Road	42	2%
SR 141/Peachtree Ind. Blvd.	41	2%
SR 6/Camp Creek Pkwy./Atlanta Airport	39	2%
All other	1246	66%
Total	**1891**	**100%**

Exit Ramp	Trips	Percent
Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree	155	8%
GA 400/T. Harvey Mathis Pkwy. (Northbound only)	101	5%
SR 9/US 19/14th St./10th St.	60	3%
I-85 SB to 10th Street/SR 9/14th Street	55	3%
MLK, Edgewood, Inter. Blvd/SR 101/Freedom Pkwy, Butler/JW Dobbs	55	3%
Almon Rd. (CR 46)	54	3%
SR 42/N. Druid Hills Road	51	3%
Farther south	46	2%
SR 6/Camp Creek Pkwy./Atlanta Airport	45	2%
I-85 to I-285 Bypass	42	2%
All Other	1227	65%
Total	**2,684**	**100%**

Note: Due to rounding, percentages may not exactly total 100%.

The most commonly cited entrance and exit ramp combination by respondents who used I-85 was the 48 people who entered I-85 by Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree and exited by GA 400/T. Harvey Mathis Pkwy.

Table 14: I-75 Ten Most Frequent Entrance and Exit Ramps

Entrance Ramp	Trips	Percent
Northside Drive/SR 3/Howell Mill Road	152	9%
Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree	112	7%
SR 9/US 19/14th St./10th St.	52	3%
SR 120 Loop/S. Marietta Pkwy.	43	3%
Farther south	41	2%
MLK, Edgewood, Inter. Blvd/SR 101/Freedom Pkwy, Butler/JW Dobbs	39	2%
SR 5/Earnest Barrett Pkwy.	39	2%
SR 5/SR 5 Spur/I-75	38	2%
Windy Hill Rd. (CR 1720)	35	2%
SR 3/US 19/US 41/Old Dixie Highway/Tara Blvd.	32	2%
All other	1077	65%
Total	**1660**	**100%**

Exit Ramp	Trips	Percent
Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree	124	7%
Northside Drive/SR 3/Howell Mill Road	81	5%
SR 9/US 19/14th St./10th St.	72	4%
MLK, Edgewood, Inter. Blvd/SR 101/Freedom Pkwy, Butler/JW Dobbs	60	4%
SR 5/SR 5 Spur/I-75	49	3%
GA 400/T. Harvey Mathis Pkwy. (NB only)	47	3%
SR 120 Loop/S. Marietta Pkwy.	46	3%
I-285	39	2%
Windy Hill Rd. (CR 1720)	39	2%
SR 5/Earnest Barrett Pkwy.	35	2%
All Other	1068	64%
Total	**1660**	**100%**

Note: Due to rounding, percentages may not exactly total 100%.

The most commonly cited entrance and exit ramp combination by respondents who used I-75 was the 21 people who entered I-75 by Northside Drive/SR 3/Howell Mill Road and exited by SR 5/SR 5 Spur/I-75.

Table 15: I-20 east of junction with I-75 Ten Most Frequent Entrance and Exit Ramps

Entrance Ramp	Trips	Percent
Windsor St./Spring St./McDaniel St.	41	5%
Wesley Chapel Rd. (CR 5196)	41	5%
Panola Rd. (CR 5150)	32	4%
SR 20/138/Stockbridge Hwy.	31	4%
SR 124/Turner Hill Rd.	27	4%
I-75/I-85	26	3%
SR 6/Thornton Rd.	25	3%
SR 139/MLK Drive/Anderson Ave.	25	3%
SR 42/Moreland Ave.	25	3%
Sigman Rd. (CR 66)	24	3%
All other	464	61%
Total	**761**	**100%**

Note: Due to rounding, percentages may not exactly total 100%.

Exit Ramp	Trips	Percent
I-75/I-85	43	6%
Windsor St./Spring St./McDaniel St.	41	5%
Capitol Avenue/Hill Street	31	4%
Wesley Chapel Rd. (CR 5196)	27	4%
SR 20/138/Stockbridge Hwy.	27	4%
SR 139/MLK Drive/Anderson Ave.	25	3%
Evans Mills Rd. (CR 6305)	25	3%
Flat Shoals Road (CR 5194 EB only)	21	3%
Panola Rd. (CR 5150)	21	3%
SR 124/Turner Hill Rd.	21	3%
All Other	479	63%
Total	**761**	**100%**

The most commonly cited entrance and exit ramp combination by respondents who used I-20 east of the junction with I-75 was the 7 people who entered I-20 east of the junction with I-75 by Windsor St./Spring St./McDaniel St. and exited by Evans Mills Rd. (CR 6305).

Table 16: I-20 west of junction with I-75 Ten Most Frequent Entrance and Exit Ramps

Entrance Ramp	Trips	Percent
Windsor St./Spring St./McDaniel St.	49	8%
SR 6/Thornton Rd.	36	6%
Panola Rd. (CR 5150)	23	4%
Wesley Chapel Rd. (CR 5196)	21	4%
SR 70/Fulton Industrial Blvd.	20	3%
SR 139/MLK Drive/Anderson Ave.	20	3%
SR 20/138/Stockbridge Hwy.	16	3%
Evans Mills Rd. (CR 6305)	15	3%
Chapel Hill Road (CR 812 WB)	14	2%
Sigman Rd. (CR 66)	14	2%
All other	363	61%
Total	591	100%

Note: Due to rounding, percentages may not exactly total 100%.

Exit Ramp	Trips	Percent
Windsor St./Spring St./McDaniel St.	57	8%
I-75/I-85	37	5%
SR 5/Bill Arp Road	24	3%
SR 6/Thornton Rd.	23	3%
Capitol Avenue/Hill Street	20	3%
SR 139/MLK Drive/Anderson Ave.	18	3%
I-285/SR 407 SB/NB	17	3%
Chapel Hill Road (CR 812 WB)	14	2%
Lee Road (CR 817)	14	2%
SR 70/Fulton Industrial Blvd.	14	2%
All Other	353	60%
Total	591	100%

There were two most commonly cited entrance and exit ramp combination. These were the 10 respondents who entered I-20 west of the junction with I-75 by Windsor St./Spring St./McDaniel St. and exited by SR 5/Bill Arp Road. Additionally, 10 respondents said they entered by SR 6/Thornton Rd. and exited by Windsor St./Spring St./McDaniel St.

Table 17: I-285 Ten Most Frequent Entrance and Exit Ramps

Entrance Ramp	Trips	Percent
SR 400/GA 400/Turner McDonald Pkwy.	84	5%
SR 141/Peachtree Ind. Blvd.	65	4%
SR 410/Decatur/Stone Mountain Fwy.	63	4%
Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree	52	3%
SR 10/Memorial Drive	51	3%
Ashford Dunwoody Rd. (CR 1764)	33	2%
I-85S/I-85N	33	2%
Chamblee Dunwoody Rd./N. Shallowford Rd./N. Peachtree Rd.	31	2%
Flat Shoals Rd./Candler Road/SR 155	29	2%
SR 12/US 278/Covington Hwy.	28	2%
All other	1218	72%
Total	**1687**	**100%**

Note: Due to rounding, percentages may not exactly total 100%.

Exit Ramp	Trips	Percent
SR 400/GA 400/Turner McDonald Pkwy.	70	4%
Chamblee Dunwoody Rd./N. Shallowford Rd./N. Peachtree Rd.	67	4%
Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree	53	3%
SR 141/Peachtree Ind. Blvd.	49	3%
SR 410/Decatur/Stone Mountain Fwy.	45	3%
SR 10/Memorial Drive	45	3%
Ashford Dunwoody Rd. (CR 1764)	42	2%
Peachtree Dunwoody Rd (CR 3377 WB only)	40	2%
I-85S/I-85N	39	2%
I-75/Cobb Pkwy./SR 3	37	2%
All Other	1200	71%
Total	**1687**	**100%**

The most commonly cited entrance and exit ramp combination by respondents who used I-285 was the 16 people who entered I-285 by SR 141/Peachtree Ind. Blvd. and exited by Courtland, Pine/Peachtree, Williams, SR 8/US 29/North Ave/Spring/W. Peachtree.

The total trip travel time varied among respondents; 20% of respondents reported a trip duration of 15 to 30 minutes, 27% a trip duration of 30 to 45 minutes, and 22% a trip duration of 45 to 60 minutes. Approximately one in eight respondents (13%) reported trips with a duration of longer than 90 minutes. Home-based work trips were most likely to be of a medium length duration, with 38% occurring lasting 45 to 75 minutes. Alternatively only 25% of home-based other trips and 30% of non-home based trips lasted from 45 to 75 minutes (Figure 26 on the following page). Likewise, a greater percentage of short (under 30 minutes) and long (greater than 90 minutes) trips were made during the off-peak, while 51% of AM peak period trips were 30 to 60 minutes long (Figure 27 on the following page).

Figure 26: Total Travel Time by Automobile Segment

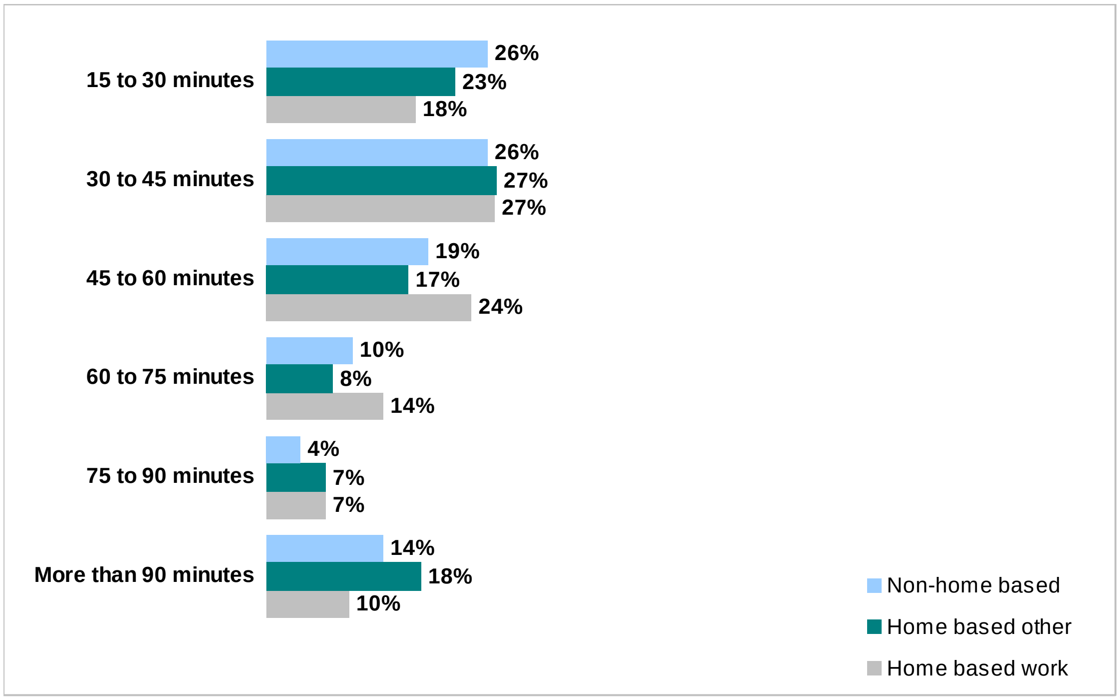
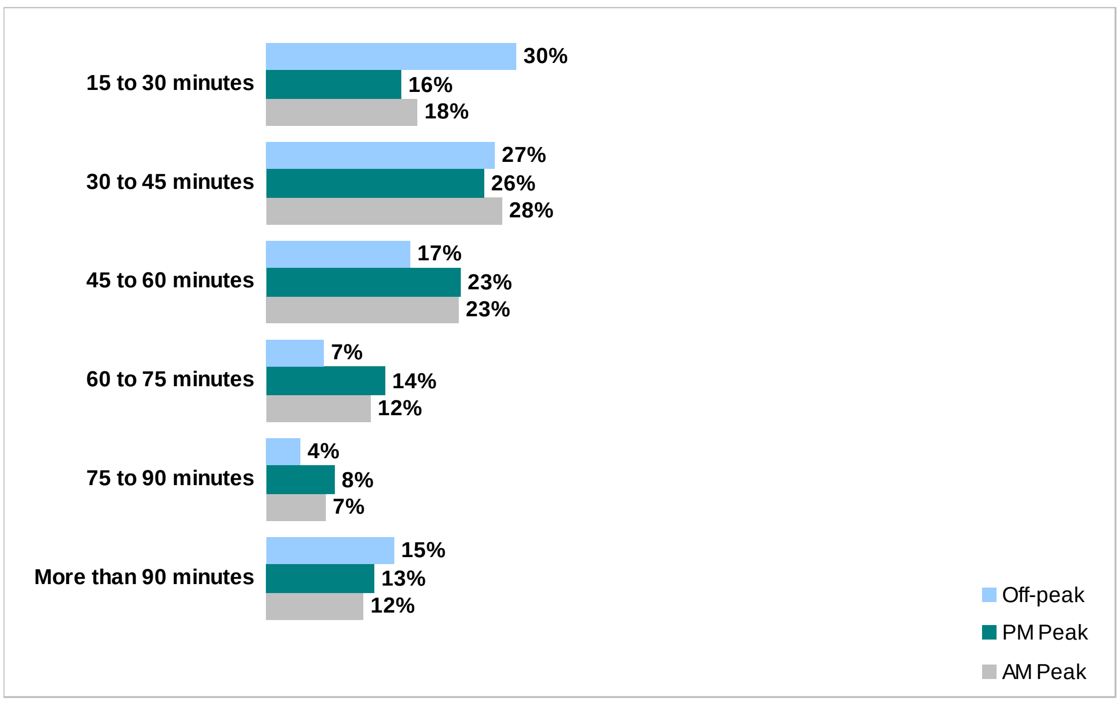
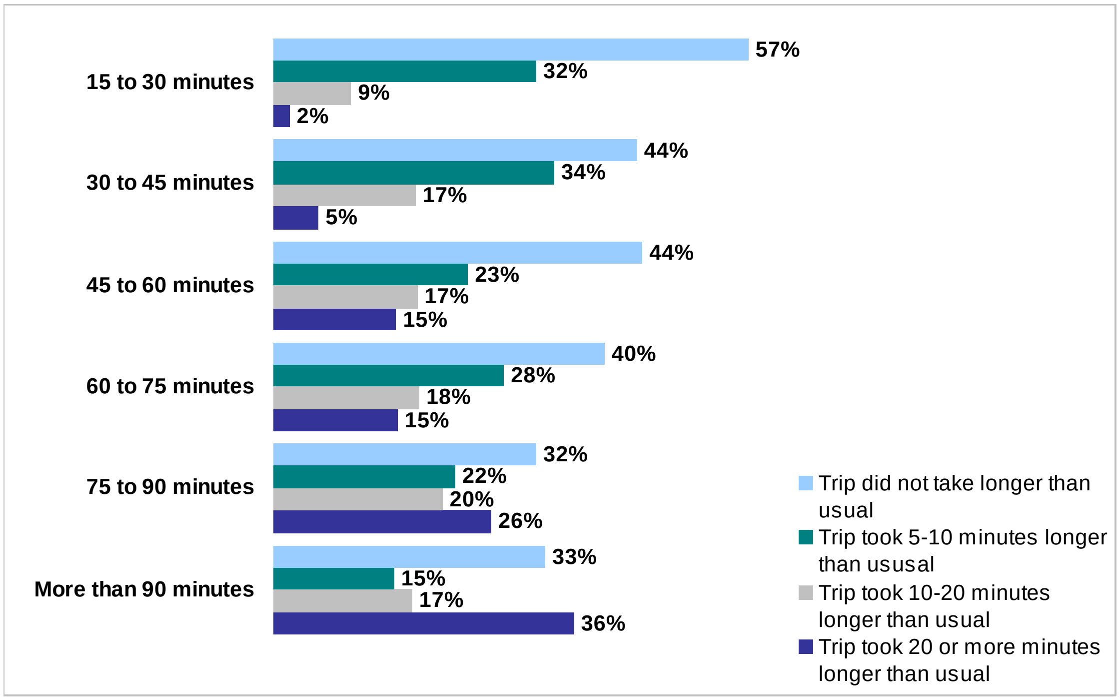


Figure 27: Total Travel Time by Time Period



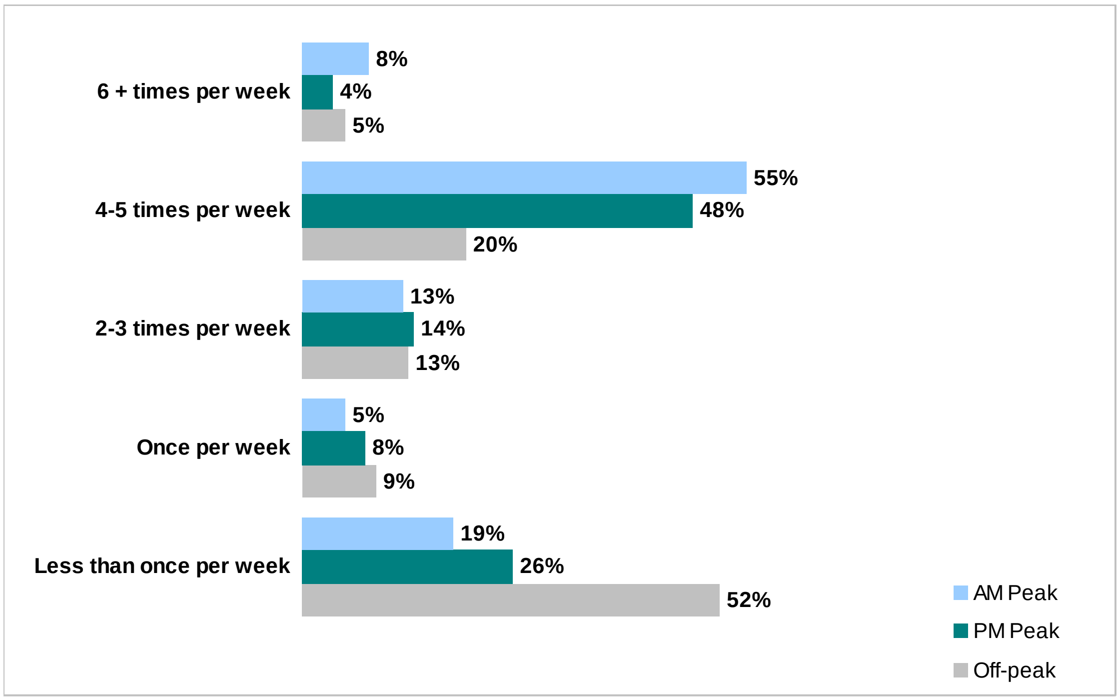
Less than half of respondents (44%) had a trip that occurred without delay, while 56% of respondents reported a delay of five or more minutes. Those respondents who reported making their trip six or seven times per week were most likely to report having experienced a delay. Seventy-three percent of these frequent travelers experienced a delay, while 27% indicated their trip occurred without delay. As is logical, the shorter the trip the more likely a respondent was to report that they did not experience a delay, while the longer the trip, the greater the number of respondents who experienced a long delay. More than a third (36%) of respondents who reported a travel time of more than 90 minutes experienced a delay of 20 or more minutes (Figure 28).

Figure 28: Total Travel Time by Amount of Delay



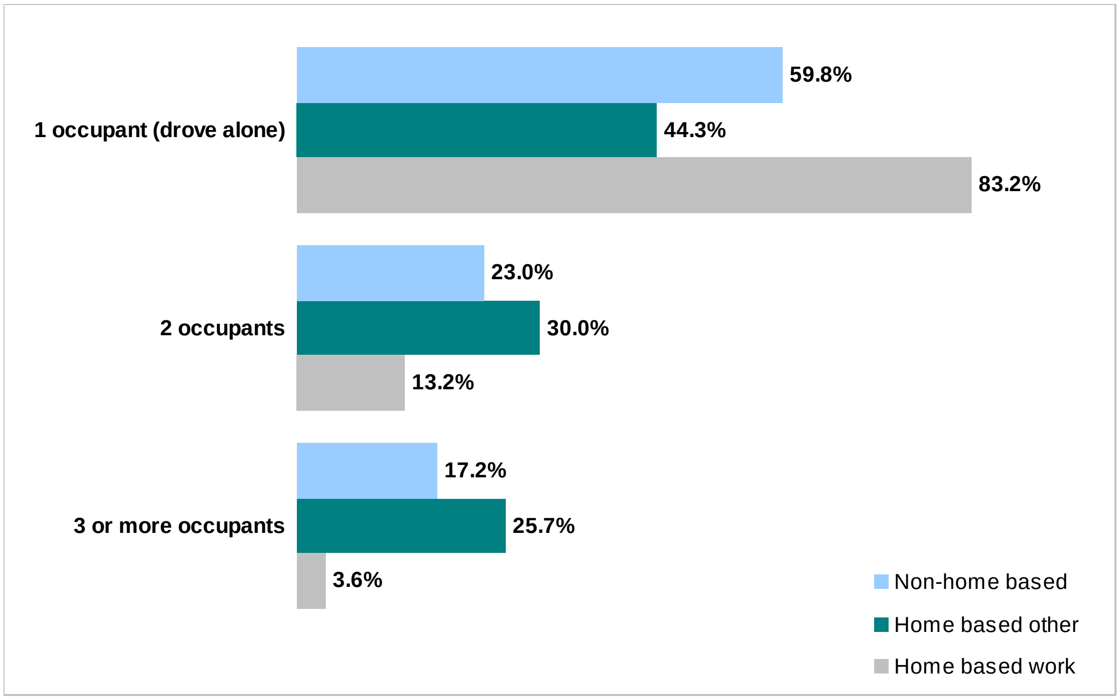
Overall, 44% of respondents reported making their trip four or five times per week. As expected, home-based work trips had a higher percentage of frequent trips, with 76% of home-based work trips occurring four or more times per week. Alternatively, 54% of non-home based trips and 59% of home-based other trips occurred less than once per week. This was consistent according to time period with 52% of off-peak trips occurring less than once per week, while 63% of AM peak trips and 52% of PM peak trips occurred more than four times per week (Figure 29).

Figure 29: Trip Frequency by Time Period



More than two-thirds (69%) of respondents reported trips in which they drove alone. The 20% of respondents who drove with one other passenger and the 11% of respondents who made trips with three or more occupants answered additional questions. Just over half (56%) of off-peak trips were made as SOV trips, while 74% of AM peak and 72% of PM peak trips were made as SOV trips. Likewise, 83% of home-based work trips were made as SOV trips, while home-based other and non-home based trips were much more likely to be HOV trips (Figure 30).

Figure 30: Occupancy by Automobile Segment



For those carpooling, most (60%) traveled with a member of their household, while 29% traveled with a friend or relative who lived elsewhere. Only 15% carpooled with a coworker. Although, 31% of respondents reported carpooling, only 16% indicated that they had used an HOV lane on their trip.

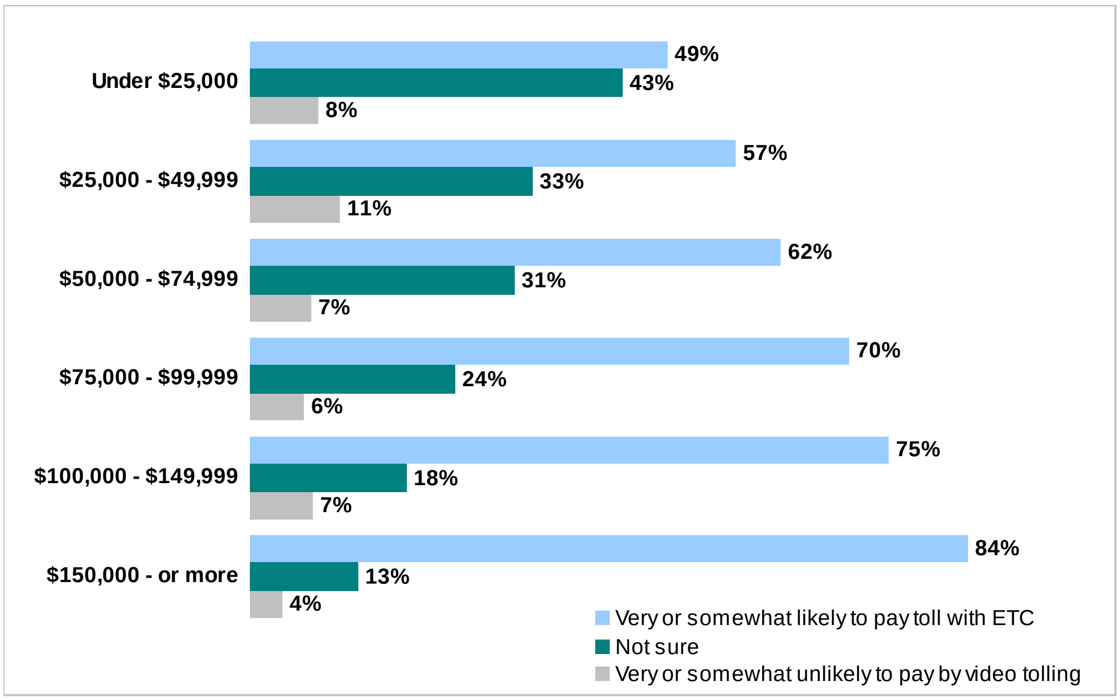
Only 9% of respondents described trips in which they paid a toll on the Georgia 400, while the remainder of respondents did not pay any tolls on their reported trip. Similarly, 89% of respondents indicated that they did not have a Georgia Cruise Card or another type of ETC transponder. Respondents who reported that I-85 was their first or last highway were much more likely to have indicated that they paid a toll on the Georgia 400 on their trip. Overall, 32% of respondents' first highway was I-85, but 51% of respondents who paid a toll on the Georgia 400 used I-85 as their first highway. Similarly, 32% of respondent's reported I-85 as their last highway, while 58% of respondents who paid a toll on the Georgia 400 used I-85 as their last highway.

Debrief

Following the stated preference section, the 3,241 respondents who selected the managed lane alternative at least once and the 932 respondents who never selected the managed lane alternative answered questions to help determine the reasons for their selections. Respondents who had selected the managed lane alternative at least once were asked their likelihood of using the proposed managed lane alternative if heavy trucks were also allowed to travel in the lane. Overall, 38% were likely or very likely and 41% were unlikely or very unlikely to continue to choose the proposed managed lane if heavy trucks were also allowed. This was consistent across route used, time of day traveled, and trip segment.

Respondents who chose a proposed managed lane alternative at least once in the stated preference section and who did not currently own an ETC transponder answered their likelihood of obtaining an ETC transponder if video tolling were more expensive. Overall, half (50%) of respondents indicated they were very likely to pay the toll using an ETC transponder instead of video tolling. This percentage was consistent regardless of if the percent discount was 0.3%, 0.45%, or 0.6%. However, higher incomes were much more likely to be likely to obtain an ETC transponder, while lower incomes were more likely to be unsure about whether they'd obtain an ETC transponder or pay by video tolling (Figure 31).

Figure 31: Likelihood of Obtaining an ETC Transponder by Income



All respondents who chose a managed lane alternative at least once indicated their reasons for choosing a managed lane alternative. Lower travel time was the most preferred answer option for all three segments and across time period. PM peak period respondents were most likely to select a shorter travel time as their reason for selecting a managed lane alternative (Figure 32). Likewise, all respondents who did not select a managed lane alternative provided their reasons. Across the three segments and across time period, respondents were primarily opposed to paying a toll (Figure 33).

Figure 32: Reason Selected A Managed Lane Alternative in the Stated Preference Section (Select All That Apply Question)

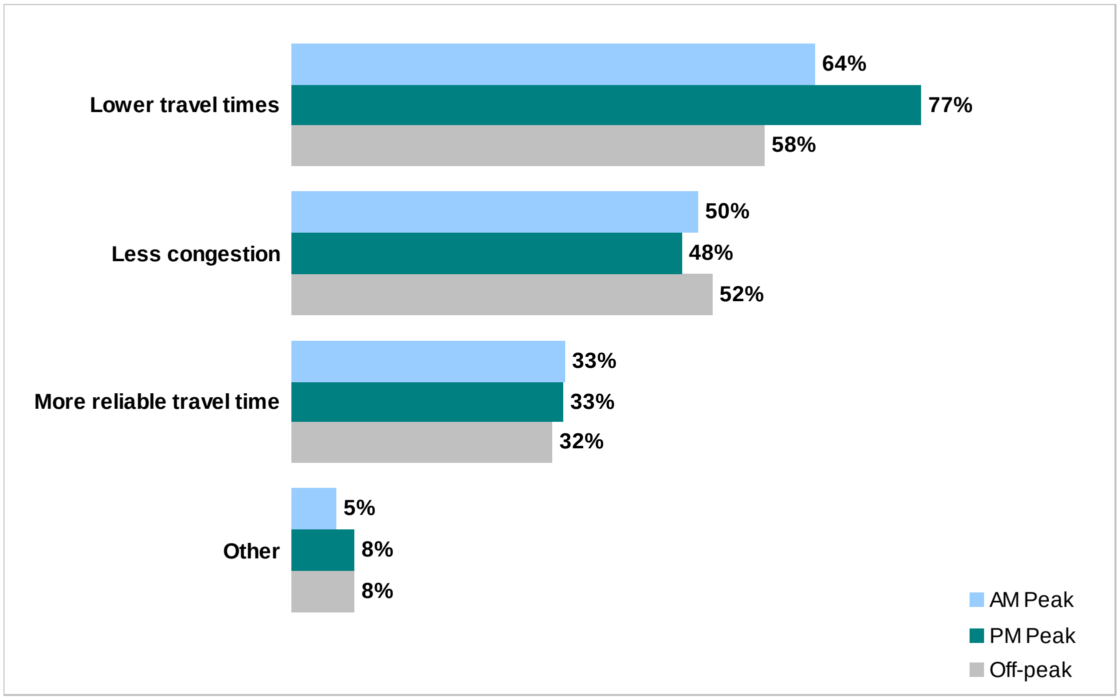
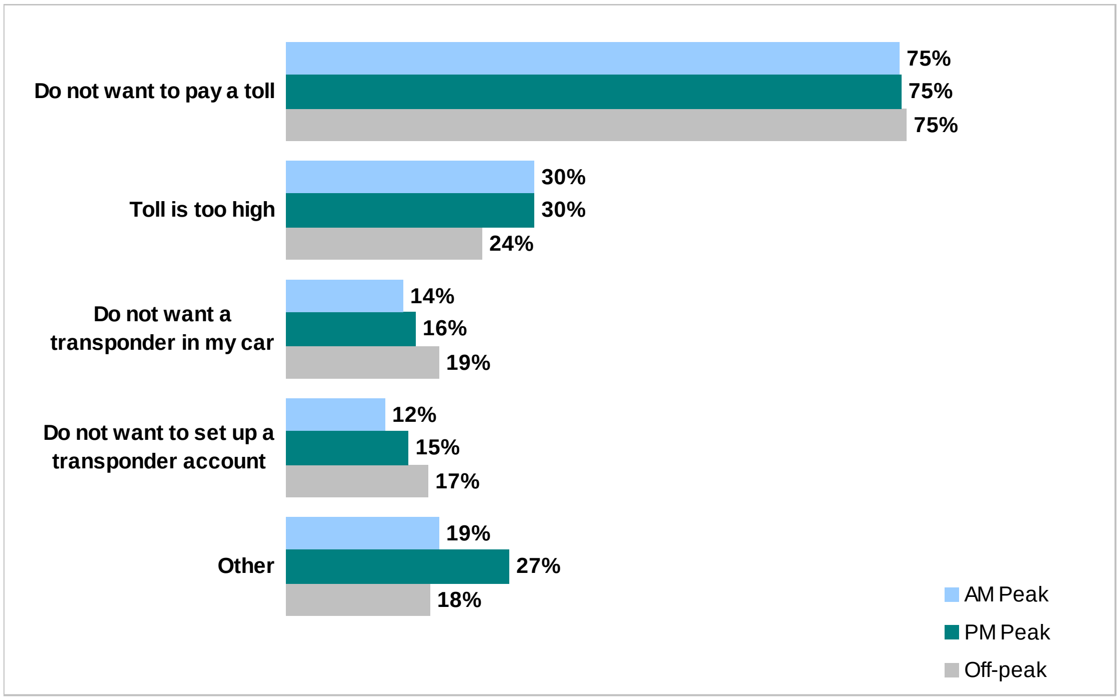


Figure 33: Reason Did Not Select A Managed Lane Alternative in the Stated Preference Section (Select All That Apply Question)



Lastly, respondents were asked to provide their reasons for why they had or had not selected a carpool managed lane option in the stated preference section. Non-carpoolers most commonly cited their preference for traveling alone, while carpoolers cited a number of reasons including convenience and saving on gas money or tolls (Figure 34 and Figure 345).

Figure 34: Reason Why Did Not Select Carpool Managed Lane Alternative in the Stated Preference Section (Select All That Apply Question)

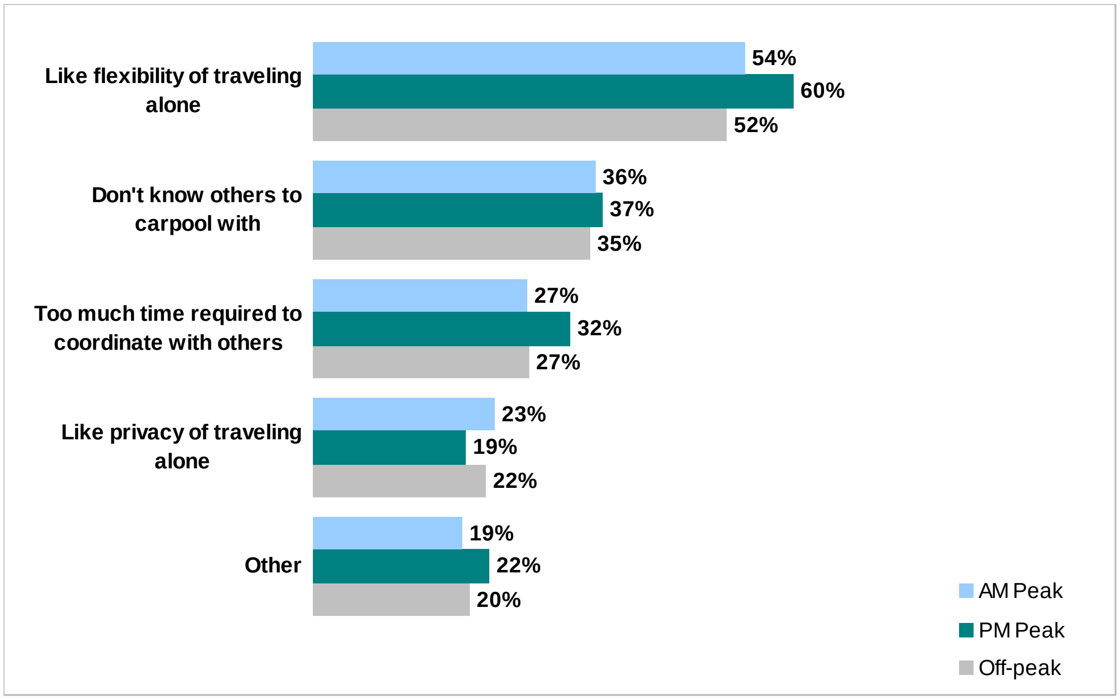
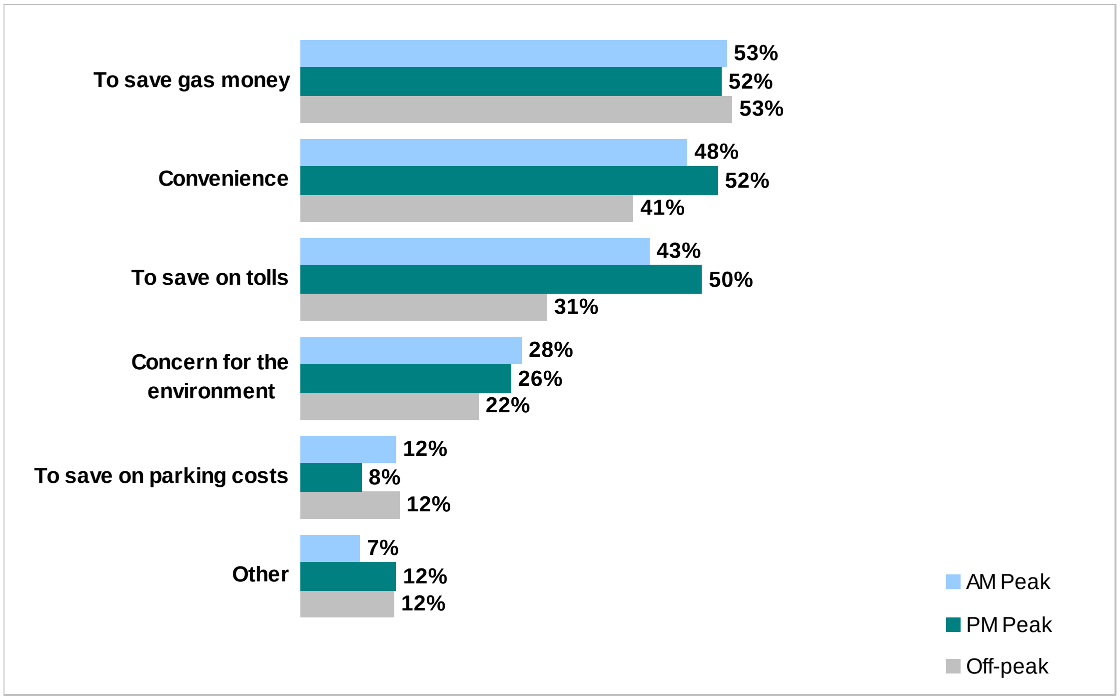


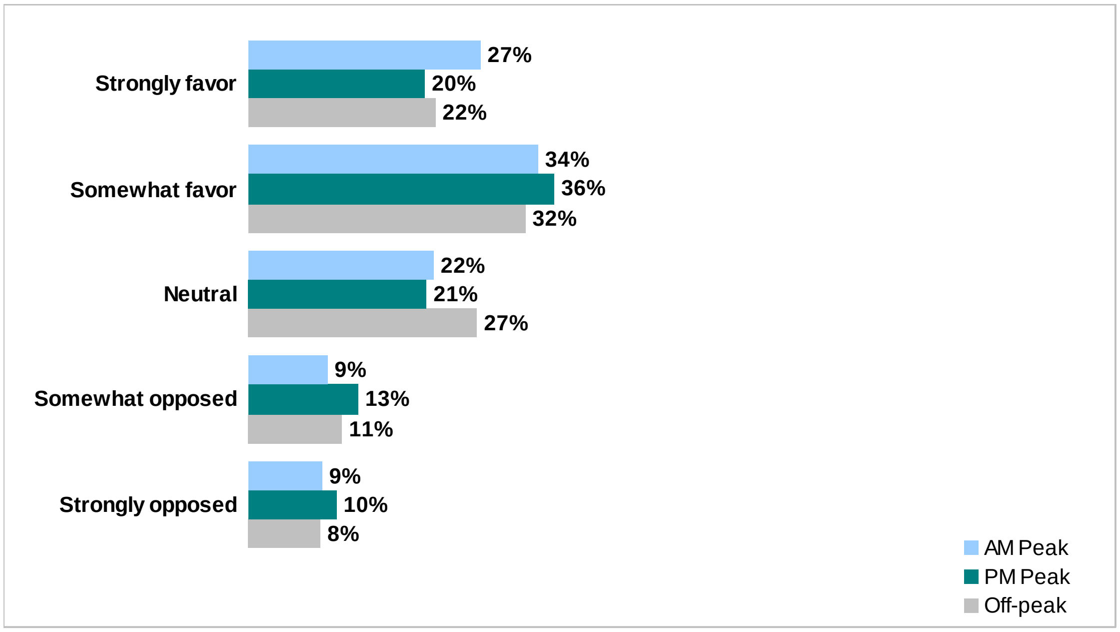
Figure 35: Reason Why Selected Carpool Managed Lane Alternative in the Stated Preference Section (Select All That Apply Question)



Opinion

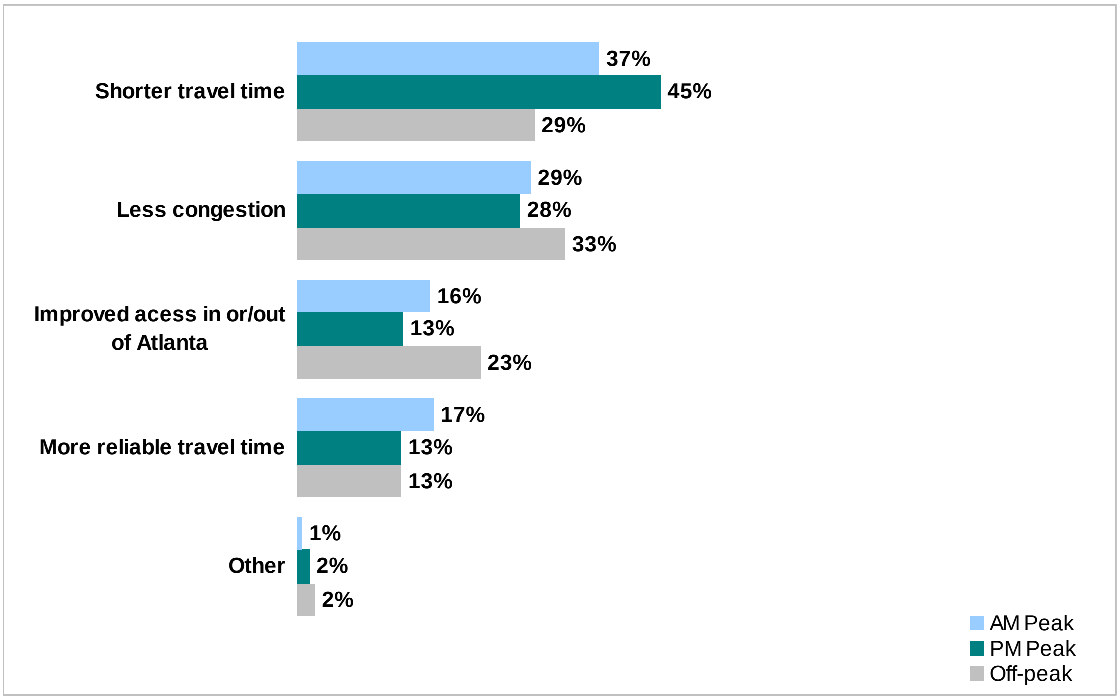
Overall, opinion of the proposed managed lanes was mixed with views as follows: 23% strongly in favor, 34% somewhat in favor, 23% neutral, 11% somewhat opposed, and 9% strongly opposed. These percentages were consistent across the route used, trip time period, and trip segment (Figure 36).

Figure 36: Opinion of Proposed Managed Lanes by Trip Time Period



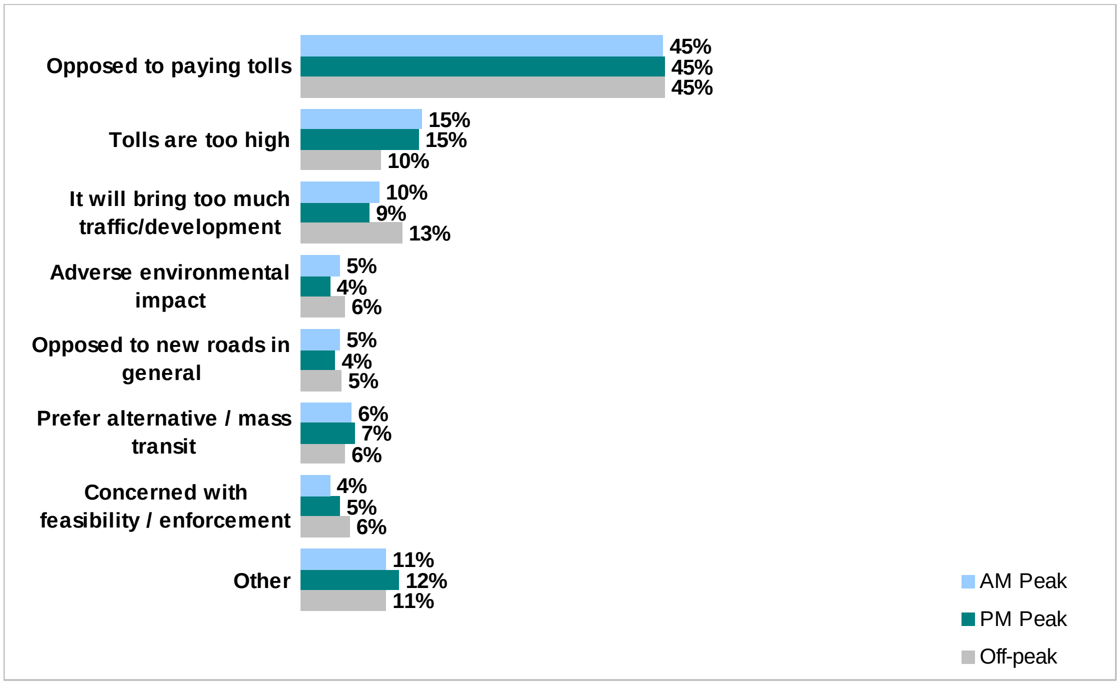
The 2,398 respondents who strongly or somewhat favored the proposed managed lanes were asked their primary reason why. More than a third (38%) believed that managed lanes would result in shorter travel time, 29% felt there would be less congestion, 17% indicated they felt the access in and out of Atlanta would be improved, and 15% felt travel time would be more reliable. Peak respondents were more likely to cite shorter travel time, while off-peak respondents more likely to choose less congestion and improved access in and out of Atlanta as their primary reason for favoring the proposed managed lanes (Figure 37).

Figure 37: Primary Reason Why Favoring Proposed Managed Lanes



While respondents (943 people) who indicated a neutral opinion of the proposed managed lanes, did not answer a follow-up question, the 832 respondents who were opposed or strongly opposed to the proposed managed lanes, gave their primary reason for their opposition. Overall, 41% were opposed to paying tolls, 27% provided another reason, and 14% felt that tolls were generally too high. These reasons were consistent across segment and time period (Figure 38).

Figure 38: Primary Reason Why Opposed to Proposed Managed Lanes



Lastly, respondents answered three attitude questions. Close to three-quarters (72%) of respondents either agreed or strongly agree that they would use a toll route if the tolls were reasonable and they would save time, while only 15% disagreed or strongly disagreed. A lesser number of respondents agreed or strongly agreed with the other two attitude questions; 58% of respondents agreed or strongly agreed that they could generally afford to pay tolls and 55% of respondents agreed or disagreed that they supported using tolls to pay for highway improvements that relieve congestion.

Demographics

To conclude the questionnaire, respondents answered a series of demographic questions. Residents of the greater Atlanta area comprised 94% of the sample, while visitors to the area accounted for the remaining 6%. Residents from over 50 Georgia counties completed the survey, with residents from Dekalb and Fulton counties accounting for 43% of respondents (Table 18).

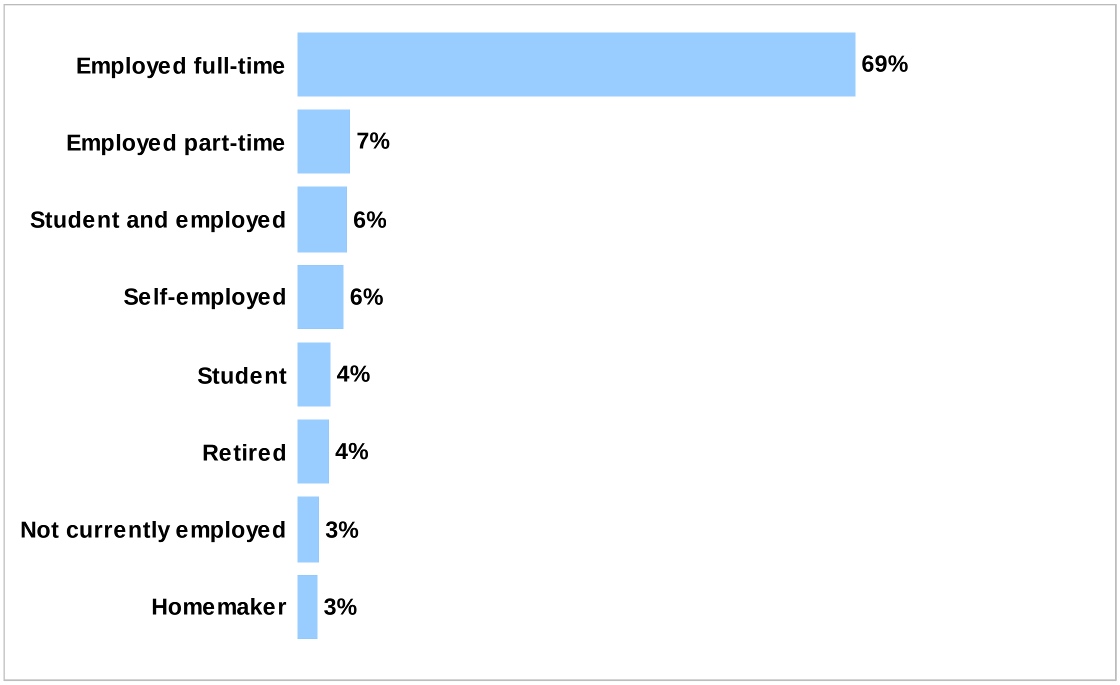
Table 18: Top Ten Counties of Residence

Top Georgia Counties of Residence	Frequency	Percentage
Dekalb County	908	22%
Fulton County	895	21%
Cobb County	603	14%
Gwinnett County	573	14%
Clayton County	179	4%
Douglas County	118	3%
Henry County	117	3%
Rockdale County	106	3%
Cherokee County	93	2%
Fayette County	82	2%
All other counties	499	12%
Total	**4173**	**100%**

More women (58%) than men (42%) completed the survey. Just over 95% of respondents had access to the internet. Of those with access to the internet, 93% had access at home and 70% had access at work. The reported household size varied, with 16% of respondents living alone, 31% living in two person households, 21% living in three person households, 21% living in four person households, and 13% living in five or more person households. The number of household vehicles was similarly dispersed; 88% of respondents owned one, two, or three vehicles. Overall, 44% of respondents reported owning two vehicles.

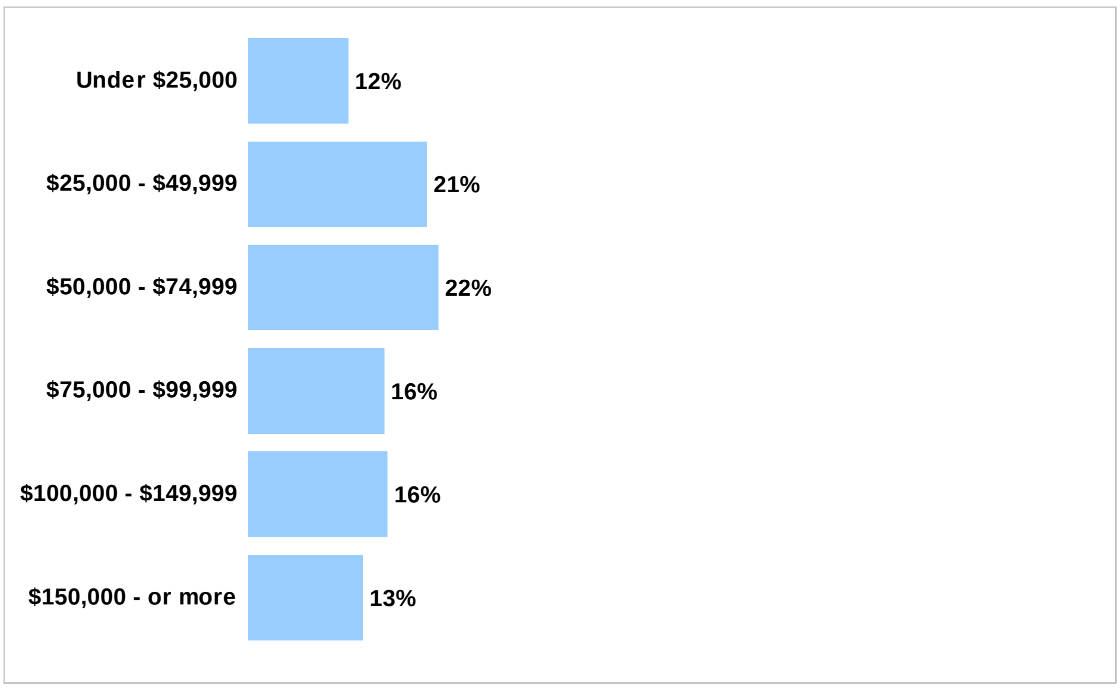
The median age of respondents was 35 to 44, with 27% of respondents falling in that age range. Another 23% of respondents were aged 25 to 34, 23% of respondents were aged 45 to 54, and 15% of respondents were aged 16 to 24. More than two-thirds (69%) of respondents indicated they were employed full-time, while an additional 12% of respondents reported they were employed part-time or self-employed (Figure 39 on the following page). More than three-quarters of PM peak and AM peak trips were made by full-time workers, with 77% and 73% respectively. Only 51% of off-peak trips were made by full-time workers.

Figure 39: Automobile Respondent Employment Status



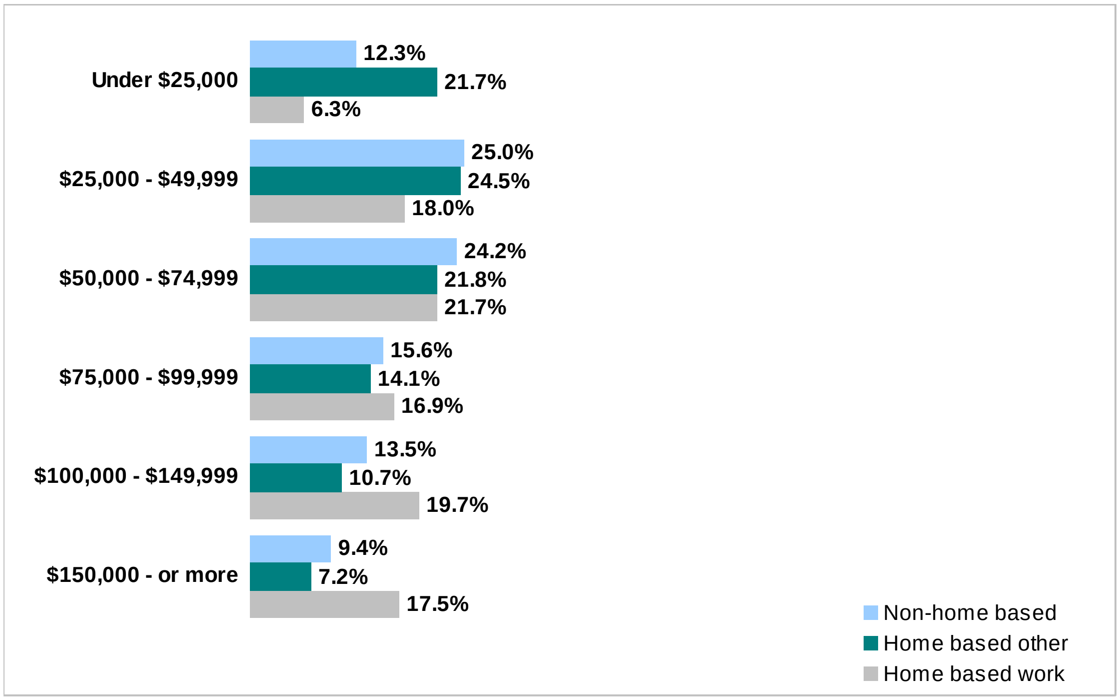
Annual household income among survey respondents was distributed as shown in Figure 40, with the median household income falling in the $50,000 to $75,000 category. Off-peak trips tended to include respondents with lower household incomes, while AM and PM peak trips included more respondents with higher incomes. This is demonstrated in that 44% of off-peak trips were respondents with household incomes of less than $50,000. Only 25% of PM peak trips and 32% of AM peak trips were by respondents with household incomes of less than $50,000. Alternatively, 39% of PM peak trips and 27% of AM peak trips were made by respondents with household incomes of more than $100,000, while only 21% of off-peak trips were by respondents with household incomes of more than $100,000.

Figure 40: Annual Household Income



Home-based work trips also had a higher percentage of high income respondents, with 37% of home-based work trips completed by respondents with household incomes greater than $100,000. Only 18% of home-based other and 23% of non-home based trips were made by respondents with household incomes greater than $100,000 (Figure 41).

Figure 41: Annual Household Income by Automobile Segment



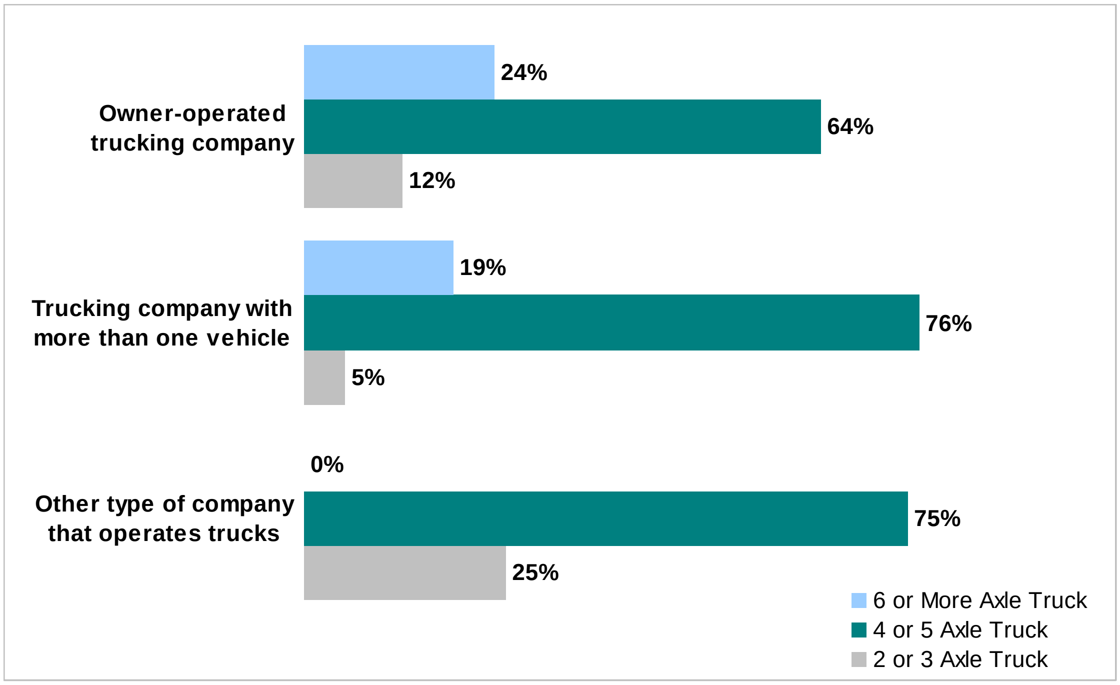
Commercial Vehicle Results

A total of 413 respondents completed the commercial vehicle survey. The descriptive analysis of the data is based on these 413 responses and is provided in three sections: trip characteristics, debrief, and demographics. A complete set of tabulations of survey questions is shown in Appendix F.

Trip Characteristics

About 56% of commercial vehicle respondents reported that that they worked for a trucking company with more than one vehicle and a further 42% of respondents indicated that they worked for an owner-operated trucking company. Overall, respondents from trucking companies with more than one vehicle primarily described trips using a larger vehicle size, with only 5% reporting a trip using a two or three axle truck (Figure 442 on the following page).

Figure 42: Type of Company by Commercial Vehicle Type

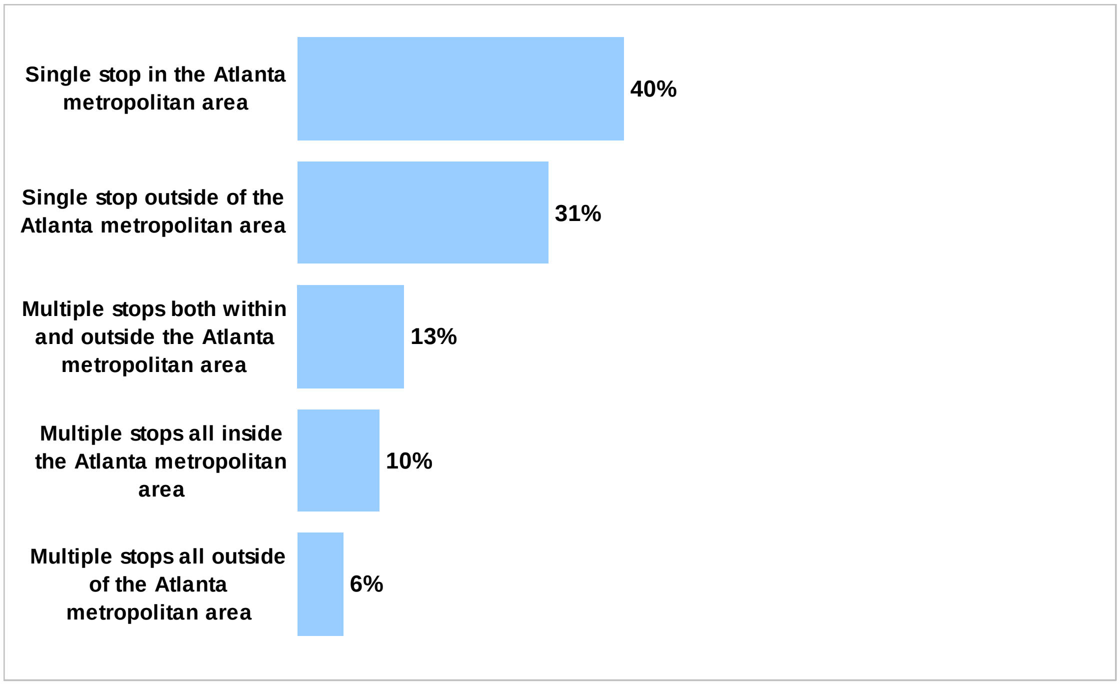


Almost all commercial vehicle respondents (410 individuals) identified themselves as drivers, while only three respondents indicated that they were a manager, dispatcher, or company owner. Drivers were divided among company drivers (57%) and fleet drivers (43%). Again, only 6% of company drivers reported a trip using a two or three axle vehicle, while the rest (94%) reported a trip driving a four or more axle vehicle. A higher percentage (12%) of fleet drivers indicated that they had driven a two or three axle vehicle for their reported trip.

Overall, 80% of commercial vehicle respondents stated that they made all their own routing decision, while only 20% said they were able to make some routing decisions. Small commercial vehicle (two or three axle vehicles) drivers were more likely to have autonomy, with 91% reporting that they made all their routing decisions. Of four or five axle vehicle drivers, 79% reported that they made all their routing decisions and 83% of six or more axle vehicle drivers indicated that they made all their routing decisions.

Commercial vehicles making a single stop in the Atlanta metropolitan area comprised 40% of respondent trips and vehicles making a single stop outside of the Atlanta metropolitan area made up a further 31% of respondent trips (Figure 453).

Figure 43: Type of Commercial Vehicle Trip



More than half (53%) of commercial vehicle respondents reported a trip that was made during an off-peak time period. Only 5% reported a PM peak period trip, with the remaining 42% reporting an AM peak period trip. Travel times varied from relatively short trips to very long trips.

Table 19: Total Travel Time by Commercial Vehicle Type

Total Travel Time	2 or 3 axle vehicle	4 or 5 axle vehicle	6 or more axle vehicle	Total Percentage
Less than 30 minutes	0.0%	0.3%	3.6%	1.0%
30–59 minutes	5.7%	6.2%	6.0%	6.1%
60–89 minutes	17.1%	8.2%	14.5%	10.4%
90–119 minutes	5.7%	6.8%	3.6%	6.5%
120–239 minutes	45.7%	31.8%	30.1%	32.4%
240–359 minutes	5.7%	15.1%	15.7%	14.3%
360–479 minutes	5.7%	8.6%	10.8%	8.7%
480–599 minutes	0.0%	9.2%	4.8%	7.5%
600 or more minutes	14.3%	13.7%	10.8%	13.1%
Total	**100%**	**100%**	**100%**	**100%**

Approximately two-thirds (65%) of the sample did not experience a delay due to traffic. Of the respondents who did report a delay, 9% reported a delay of 10 minutes, 22% reported a delay of 10 to 20 minutes, 27% reported a delay of 20 to 30 minutes, and 41% reported a delay of longer than a half hour. One respondent didn’t know how long their delay had been.

Of the 413 respondents, only one reported that they had paid a toll on their trip. Respondents from trucking companies with more than one vehicle or from another type of trucking company that wasn't owner-operated answered who was responsible for paying any tolls incurred on their trip. Less than one-third (29%) reported that their company pays tolls directly using Georgia Cruise Card or another form of an ETC. Instead, 64% indicated drivers pay tolls and are reimbursed by the company and only 7% stated that they pay tolls themselves.

Debrief

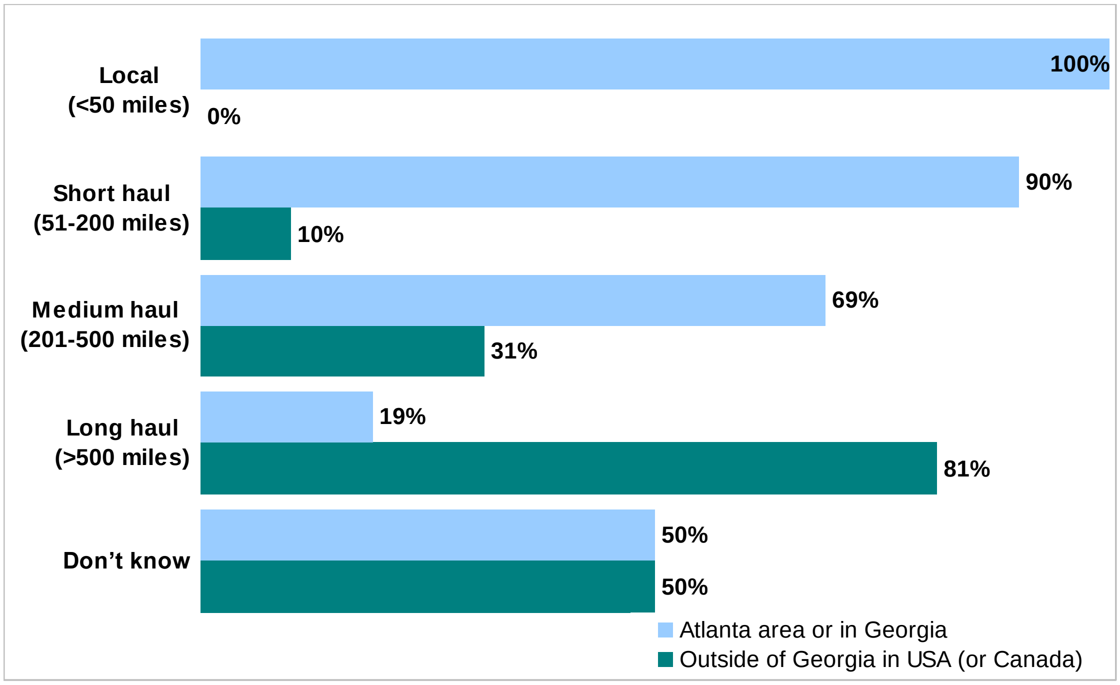
All commercial vehicle respondents gave their opinion for adding TOT lanes to I-85, I-75, I-20, and I-285. Almost half, 45%, strongly opposed TOT lanes, with a further 6% somewhat opposed. Alternatively, 19% strongly favored TOT lanes, with 15% somewhat in favor.

General opposition to paying tolls was the primary reason given by 59% of those opposed to TOT lanes. Additionally, 16% stated that they believed tolls were too high. For respondents in favor of creating TOT lanes, 35% believed that TOT lanes would improve access into and out of Atlanta and 34% indicated that TOT lanes would lead to less congestion.

Commercial Vehicle Company Demographics

Slightly more than two-thirds (68%) of commercial vehicle respondents reported that their company headquarters were located outside of Georgia in the USA or Canada, while 24% reported Atlanta area headquarters and 8% reported headquarters in Georgia outside of the Atlanta area. Logically, respondents with company headquarters outside of Georgia tended to report making long haul trips of more than 500 miles with four or five axle commercial vehicles, rather than shorter length trips with smaller sized commercial vehicles (Figure 44 on the following page). Almost three-quarters (73%) of four and five axle commercial vehicle trips were reported by respondent's whose company headquarters were located outside of Georgia. Smaller trucks (two and three axle vehicles) were evenly divided among respondents with company headquarters outside of Georgia (51%) and in the Atlanta area or in Georgia (49%).

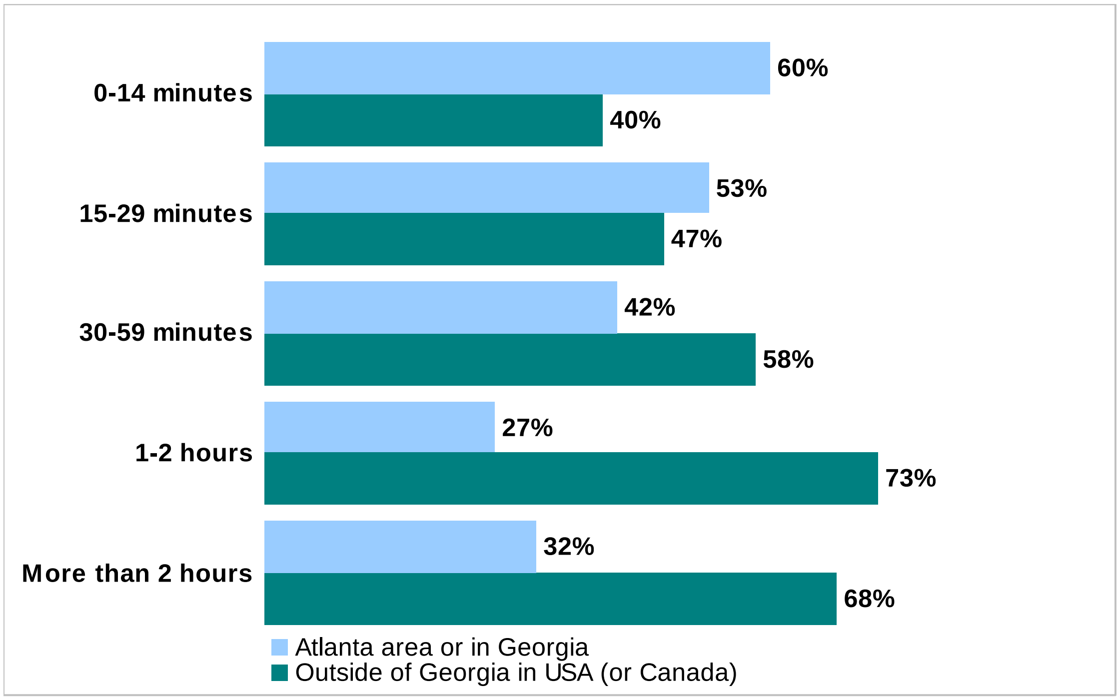
Figure 44: Commercial Vehicle Average Reported Trip Length by Location of Company Headquarters



Overall, 56% of commercial vehicle respondents reported that they had a flexible delivery schedule, while 44% reported they were held to a fixed delivery schedule. Of those with flexible delivery schedules, 35% had company headquarters in the Atlanta area or Georgia, whereas of those with fixed delivery schedules, only 28% had company headquarters in the Atlanta area or Georgia.

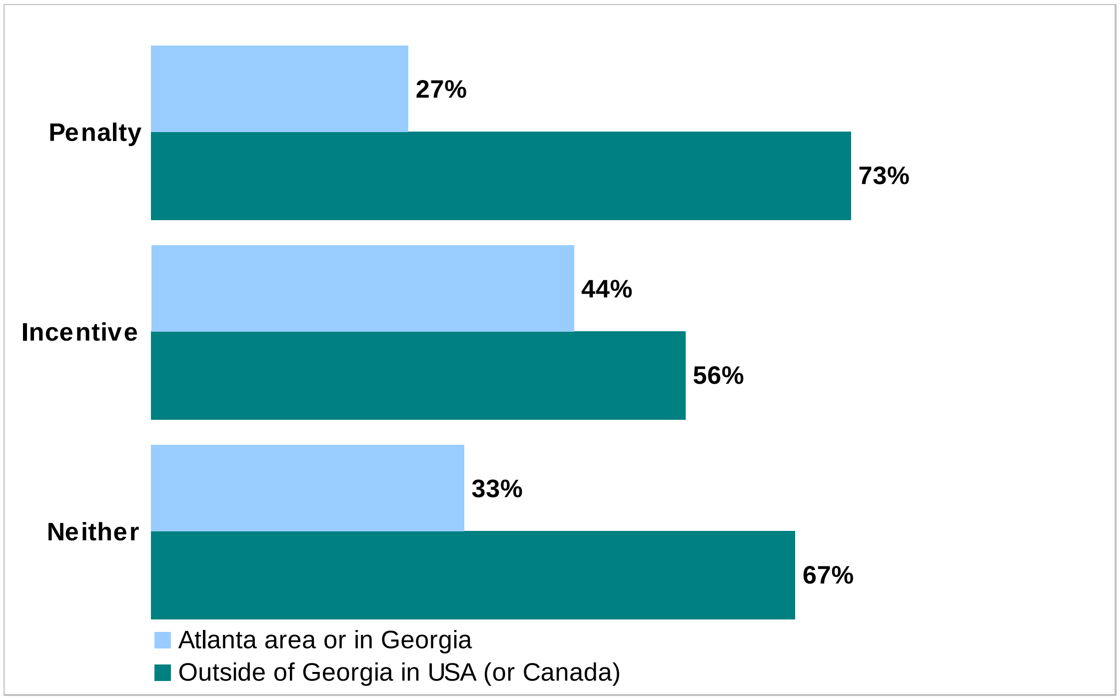
Respondents with flexible delivery schedules reported the level of flexibility of their delivery schedule in minutes. Again, respondents with company headquarters located outside of Georgia were more likely to reported longer time periods in terms of delivery flexibility. Logically, these trips are longer in duration and distance and have a larger uncertainty in terms of delivery time.

Figure 45: **Level of Shipment Delivery Schedule Flexibility by Location of Company Headquarters**



All commercial vehicle respondents were asked the timeframe structure for deliveries. One-third (33%) reported a penalty timeframe structure, whereas more than half (56%) reported neither a penalty nor an incentive timeframe structure. Again, respondents with company headquarters located outside of Georgia were more likely to indicate that they had a penalty timeframe structure for deliveries.

Figure 46: Timeframe Structure for Deliveries by Location of Company Headquarters



Lastly, respondents were asked about the type of shipments handled by their company. The clear majority (87%) stated that their company handled truckload shipments of 10,100 pounds or more that don't require a terminal or break-bulk operation.

Model Estimation

Methodology and Alternatives

In each stated preference experiment for auto travelers, the following three alternatives were presented for making a future trip, unless the respondent reported a vehicle occupancy of three or more, in which case the third option – carpool lanes with additional occupants – was omitted.

1. General purpose lanes with current occupancy
2. Managed lanes with current occupancy, and with a shorter travel time and associated toll [2]
3. Carpool lanes with additional occupant, and with a shorter overall travel time (but with additional time for added occupants) and reduced or no toll

[2] Information from their current route was used to generate the travel time levels, toll cost, and occupancies that were shown for each alternative route.

Responses from the stated preference experiments were expanded into a dataset containing eight or nine observations for each of the 4,173 respondents, yielding a total of 34,857 observations. (Respondents who chose the same option through eight experiments were shown a ninth experiment to induce trading.) The data were used to support estimation of the coefficients of a multinomial logit (MNL) choice model[3] for six model segments within each of five study corridors. Results from the MNL models were then used to derive full distributions of model coefficients such as travel time sensitivity using mixed multinomial logit (MMNL) analysis.

Respondents operating commercial vehicles were shown stated preference scenarios with two alternatives:

1. Existing lanes
2. New truck only toll lanes with a shorter travel time and associated toll

As in the auto survey, non-trading respondents (respondents who chose the same option through eight scenarios) were presented a ninth scenario to encourage trading. These eight or nine observations per 413 truck respondents yielded a dataset of 3,555 observations that underwent similar MNL and MMNL analysis.

Identification of Outliers

Data was screened to ensure that all observations included in model estimation represented realistic trips and reasonable consideration of the trade-offs in the stated preference exercises. To validate trips for both auto and commercial respondents, the reported origin and destination were geocoded to TAZs, which were combined with skim data to generate an expected travel time. If the respondent's reported travel time was significantly longer or shorter than the expected travel time, the respondent's data was excluded from analysis. Additionally, the time in which the respondent completed both the stated preference exercise and the survey as a whole were analyzed and respondents with very rapid completion times were excluded from model estimation.

Model Specification

For auto trips, several utility equation structures were tested using the variables included in the stated preference experiments as well as trip characteristic and demographic variables. Specification testing included evaluation of various alternative-specific constants, bias-removing variables, distance effects, and transformations of toll cost by household income. In the final specification, coefficients were determined for travel time, toll cost, and the addition of two vehicle occupants. Coefficients were also specified for the five possible opinions of the project in order to capture strategic bias in stated preference responses. An alternative-specific constant

[3] The multinomial logit model has the general form $p(i) = \frac{e^{U_i}}{\sum_{AllModes} e^{U_j}}$ where *p(i)* is the probability that mode *i* will be chosen and U_i is the "utility" of mode *i*, a function of service and other variables. See, for example, M. E. Ben-Akiva and S. R. Lerman, *Discrete Choice Analysis*, MIT Press, 1985, for details on the model structure and statistical estimations procedures.

was specified for the general purpose lanes alternative and the managed lanes alternative (Table 20).

Table 20: Auto Model Specification

Coefficient	Units	Alternatives		
		General Purpose Lanes	Managed Lanes	Carpool Lanes
Time	minutes	X	X	X
Cost	Dollars	X	X	X
Toll Dummy – Strongly Favor	(0,1)	X	X	X
Toll Dummy – Somewhat Favor	(0,1)	X	X	X
Toll Dummy – Neutral	(0,1)	X	X	X
Toll Dummy – Somewhat Opposed	(0,1)	X	X	X
Toll Dummy – Strongly Opposed	(0,1)	X	X	X
GPL Constant	(0,1)	X		
ML Constant	(0,1)		X	
Occ Dummy – Add 2 Passengers	(0,1)			X

Transformations of the cost and time coefficients by total trip distance and household income were tested in order to capture any systematic relationship between time and/or cost sensitivity and income or distance. To test for this relationship, the elasticities of the time and cost coefficients relative to trip distance were estimated by including the following transformations of the time and cost coefficients in the utility equation:

$$V_i = \cdots + \beta_t TT_i \left(\frac{dist}{\overline{dist}} \right)^{\lambda_{t,dist}} + \beta_c T_i \left(\frac{dist}{\overline{dist}} \right)^{\lambda_{c,dist}} + \ldots$$

Where:

TT_i gives the travel time of alternative i

T_i gives the toll cost of alternative i

dist gives the trip distance for the current respondent, with $\overline{dist}$ giving the base value, the average trip distance for the sample

The remaining terms are estimated in the model:

The term β_t is the time sensitivity (in 1/min)

The term β_c is the cost sensitivity (in 1/$)

The interaction terms: $\lambda_{t,dist}$ gives the time elasticity in relation to trip distance, and $\lambda_{c,dist}$ gives the cost elasticity in relation to trip distance.

These effects were tested for each of the six trip purpose/time of day segments within each study corridor. When interacting the cost coefficient with distance, the estimated elasticity coefficient was negative and significantly different from zero for most of the model segments, indicating that, in general, cost sensitivity decreases as trip distance increases. For distance interactions with time, the estimated elasticity coefficient was also negative and significantly different from zero for most of the model segments, generally indicating that time sensitivity decreases as trip distance increases. In the majority of cases where both distance transformations were significant, the decrease in cost sensitivity was greater than the decrease in time sensitivity, indicating that, overall, value of time increases as trip distance increases.

A similar approach was used to test for a relationship between cost sensitivity and household income according to the equation:

$$V_i = \cdots + \beta_c T_i \left(\frac{inc}{\overline{inc}} \right)^{\lambda_{c,inc}} + \ldots$$

Where:

T_i gives the toll cost of alternative i

inc gives the household income for the current respondent, with $\overline{inc}$ giving the base value, the average household income for the sample

The remaining terms are estimated in the model:

The term β_c is the cost sensitivity (in 1/$)

The interaction term $\lambda_{c,inc}$ gives the cost elasticity in relation to income

The cost elasticity in relation to income was estimated for each of the six segments within each corridor. The estimated elasticity coefficient was negative and significantly different from zero for most of the model segments, indicating that, in general, cost sensitivity decreases as household income increases. This results in an increase in value of time as household income increases.

Commercial vehicle models underwent similar specification testing, with coefficients in the final specification estimated for time, cost, and opinion (Table 21).

Table 21: Commercial Model Specification

Coefficient	Units	Alternatives	
		General Purpose Lanes	New Truck Only Toll Lanes
Time	minutes	X	X
Cost	dollars	X	X
Toll Dummy – Strongly Favor	(0,1)	X	X
Toll Dummy – Somewhat Favor	(0,1)	X	X
Toll Dummy – Neutral	(0,1)	X	X
Toll Dummy – Somewhat Opposed	(0,1)	X	X
Toll Dummy – Strongly Opposed	(0,1)	X	X

As in the auto models, a time elasticity and cost elasticity relative to trip distance were estimated to determine if a systematic relationship exists between trip distance and time and cost sensitivity. A transformation of the cost coefficient was also tested to evaluate whether a relationship exists between cost sensitivity and the number of vehicle axles. This specification followed the same form as the previous transformations:

$$V_i = \cdots + \beta_c T_i \left(\frac{axles}{\overline{\overline{axles}}} \right)^{\lambda_{c,axles}} + \ldots$$

Where:

T_i gives the toll cost of alternative i

axles gives the number of truck axles reported by the current respondent, with $\overline{axles}$ giving the base value, the average number of axles for the sample

The remaining terms are estimated in the model:

The term β_c is the cost sensitivity (in 1/$)

The interaction term $\lambda_{c,axles}$ gives the cost elasticity in relation to the number of axles

The distance transformations on cost sensitivity and time sensitivity were statistically significant and negative in both cases meaning that, as trip distance increases, both cost sensitivity and time sensitivity decrease. The magnitude of the cost elasticity coefficient exceeds the magnitude of the time elasticity coefficient, indicating that, as trip distance increases, overall value of time increases. The cost elasticity related to the number of axles was also negative and significantly different from zero demonstrating that sensitivity to toll cost decreases as the number of vehicle axles increases. This results in an increase in value of time as the number of vehicle axles increases.

Segmentation

Models were estimated for six auto traveler segments, including three trip purpose segments – home-based work, home-based other purpose, and non-home based– and three time period segments – AM peak, PM peak, and off-peak. Models for these six segments were estimated for each of the five study corridors – I-85, I-75, I-20 east of I-75, I-20 west of I-75. and I-285 – resulting in a total of 30 model runs (Table 22).

Table 22: Traveler Market Segments

	Segment	**Description**
Purpose	Home-based work	Home as origin or destination and work purpose
	Home-based other	Home as origin or destination and non-work purpose
	Not home-based	Home not origin or destination
Time Period	AM Peak	6 AM – 10 AM
	PM Peak	3 PM – 7 PM
	Off-peak	All other times

Various segments were tested for commercial vehicles including the number of axles, the study corridor, the respondent's job position, and the company's schedule type. Using the previously described distance and axle transformations on the entire truck sample was found to provide the best model fit.

Aggregate model coefficients - MulTINOMIAL Logit models

Table 23 (on the following page) presents the results of an aggregate MNL model run on the home-based work segment of I-20 East using the specification described in Table 20. (The MNL model results for all segments within all corridors can be found in Appendix G.) For each model, coefficient values, standard errors and t-statistics are presented. The statistics included for each model are number of observations, Log Likelihood at zero and at convergence, and two model fit measures: Rho-Squared and adjusted Rho-Squared. Results from the aggregate MNL model run for commercial vehicles are found in Table 24 (on the following page).

Table 23: I-20E Home-Based Work MNL Model Coefficients

Coefficient	Units	Value	Standard Error	T-Stat
Time	Minutes	-0.0372	0.00269	-13.8
Cost	Dollars	-0.242	0.0182	-13.3
Toll Dummy – Strongly Favor	(0,1)	0.538	0.134	4.03
Toll Dummy – Somewhat Favor	(0,1)	-0.115	0.128	-0.9
Toll Dummy – Neutral	(0,1)	-0.7	0.139	-5.03
Toll Dummy – Somewhat Opposed	(0,1)	-1.23	0.196	-6.25
Toll Dummy – Strongly Opposed	(0,1)	-2.05	0.238	-8.59
GPL Constant	(0,1)	2.07	0.12	17.2
ML Constant	(0,1)	1.51	0.108	14
Occupancy Dummy – Add 2 Passengers	(0,1)	-0.0936	0.133	-0.705
Cost-Distance Elasticity	–	-1.13	0.0986	-11.5
Cost-Income Elasticity	–	-0.166	0.0696	-2.38
Time-Distance Elasticity	–	-0.895	0.114	-7.89

Number of Observations	3420
Log Likelihood at 0	-3670.08
Log Likelihood at Convergence	-2447.18
Rho-Squared	0.333
Rho-Squared Adjusted	0.33

Table 24: Commercial MNL Model Coefficients

Coefficient	Units	Value	Standard Error	T-Stat
Time	Minutes	-0.026	0.002	-11.363
Cost	Dollars	-0.067	0.005	-12.668
Toll Dummy – Strongly Favor	(0,1)	0.451	0.118	3.840
Toll Dummy – Somewhat Favor	(0,1)	-0.373	0.132	-2.834
Toll Dummy – Neutral	(0,1)	-1.215	0.139	-8.739
Toll Dummy – Somewhat Opposed	(0,1)	-1.919	0.233	-8.224
Toll Dummy – Strongly Opposed	(0,1)	-3.217	0.154	-20.886
Cost-Distance Elasticity	–	-0.709	0.144	-4.919
Time-Distance Elasticity	–	-0.572	0.163	-3.515
Cost-Axle Elasticity	–	-1.061	0.278	-3.812

Number of Observations	3555
Log Likelihood at 0	-2464.14
Log Likelihood at Convergence	-1235.23
Rho-Squared	0.499
Rho-Squared Adjusted	0.495

Distributions of Model Coefficients – Mixed Multinomial LOGIT Models

Following specification tests using a MNL model form, MMNL models were estimated. The MMNL models capture individual preference heterogeneity not accounted for in MNL models by segmentation or model specification, and allow VOT distributions to be estimated for each segment. The improved fit to respondent's choices achieved using the MMNL model form indicates that they explain preferences more completely than MNL models.

MMNL models were estimated using the same specification identified in the preliminary MNL models for each of the auto segments. The time coefficient in the MMNL models was estimated as a random variable using a log-normal distribution. The estimation results for the home-based work segment of the I-20 East corridor are found in Table 25 (on the following page). The table includes model coefficient values, standard errors, t-statistics, and model statistics. (MMNL results for all segments can be found in Appendix H.)

The t-statistics for the standard deviations in travel time show that those standard deviations are significantly different from zero in all models, indicating that the models are identifying heterogeneity in travel time sensitivity in each traveler segment.

The specification for the auto MMNL includes the cost distance elasticity, time distance elasticity, and cost income elasticity as fixed values. The toll costs and travel times are factored by the relevant elasticity term(s) prior to estimation using the elasticity values estimated in the preliminary MNL models. This allows for the relationships between cost sensitivity and travel distance, cost sensitivity and income, and time sensitivity and travel distance to be captured in the MMNL model.

Table 25: I-20E Home-Based Work MMNL Model Coefficients

Coefficient	Units	Value	Standard Error	T-Stat
Time	Minutes	-2.76	0.138	-20
Time Standard Deviation	Minutes	0.904	0.114	7.95
Cost	Dollars	-0.728	0.0404	-18
Toll Dummy – Strongly Favor	(0,1)	1.41	0.303	4.64
Toll Dummy – Somewhat Favor	(0,1)	0.392	0.279	1.41
Toll Dummy – Neutral	(0,1)	-0.718	0.338	-2.12
Toll Dummy – Somewhat Opposed	(0,1)	-0.48	0.551	-0.872
Toll Dummy – Strongly Opposed	(0,1)	-1.91	0.627	-3.04
GPL Constant	(0,1)	3.7	0.277	13.3
ML Constant	(0,1)	2.5	0.23	10.9
Occupancy Dummy – Add 2 Passengers	(0,1)	0.108	0.184	0.59
Cost-Distance Elasticity	–	-1.13	0.0986	-11.5
Cost-Income Elasticity	–	-0.166	0.0696	-2.38
Time-Distance Elasticity	–	-0.895	0.114	-7.89

Number of Observations	3420
Log Likelihood at 0	-3670.08
Log Likelihood at Convergence	-1796.81
Rho-Squared	0.51
Rho-Squared Adjusted	0.507

The specification for the truck MMNL includes the cost distance elasticity, time distance elasticity, and cost axle elasticity as fixed values. As in the auto models, the toll costs and travel times use the elasticity values estimated in the preliminary MNL models and allow for the relationships between cost sensitivity and travel distance, cost sensitivity and number of axles, and time sensitivity and travel distance to be captured in the MMNL model (Table 26 on the following page).

Table 26: Commercial MMNL Model Coefficients

Coefficient	Units	Value	Standard Error	T-Stat
Time	Minutes	-2.893	0.146	-19.868
Time Standard Deviation	Minutes	0.892	0.082	10.881
Cost	Dollars	-0.217	0.016	-13.421
Toll Dummy – Strongly Favor	(0,1)	1.522	0.451	3.373
Toll Dummy – Somewhat Favor	(0,1)	-0.079	0.483	-0.163
Toll Dummy – Neutral	(0,1)	-2.021	0.507	-3.985
Toll Dummy – Somewhat Opposed	(0,1)	-2.634	0.733	-3.594
Toll Dummy – Strongly Opposed	(0,1)	-5.831	0.531	-10.984
Cost-Distance Elasticity	–	-0.709	0.144	-4.919
Time-Distance Elasticity	–	-0.572	0.163	-3.515
Cost-Axle Elasticity	–	-1.061	0.278	-3.812

Number of Observations	3555
Log Likelihood at 0	-3464.14
Log Likelihood at Convergence	-881.497
Rho-Squared	0.639
Rho-Squared Adjusted	0.0058

Mean Values of Time and value of time Distributions

Mean VOTs based on the MMNL model results for each auto segment are shown in Table 27 (on the following page). The VOTs for each of the segments are estimated at the mean household income and mean trip distance for the corridor; these mean values are also shown in the table. The VOT values should be interpreted with some caution as mean values from a non-normal distribution are affected by the shape of the distribution and particularly the shape of the tail of the distribution.

Table 27: Mean Values of Time for Auto Segments

Segment	Value of Time ($/hour)				
	I-20E	I-20W	I-75	I-85	I-285
Home-based work	$ 7.89	$ 10.79	$ 7.64	$ 8.20	$ 7.86
Home-based other	$ 11.74	$ 15.71	$ 9.23	$ 10.69	$ 10.15
Not home-based	$ 9.04	$ 12.89	$ 8.29	$ 8.86	$ 9.06
AM Peak	$ 10.41	$ 15.25	$ 9.97	$ 9.39	$ 9.26
PM Peak	$ 7.71	$ 8.70	$ 7.84	$ 7.35	$ 8.20
Off-peak	$ 7.18	$ 10.40	$ 9.57	$ 11.99	$ 10.54
Average Income ($/year)	$ 69,629	$ 72,737	$ 86,262	$ 85,020	$ 78,632
Average Distance (miles)	26.8	27.5	26.7	26.9	26.4

For commercial vehicles, a mean VOT of $22.95 was estimated from the MMNL model. This value was calculated at the average number of vehicle axles (five) and the average distance traveled (63.7 miles). Table 28 shows the mean values of time for commercial vehicles by number of axles, all calculated at the average trip distance.

Table 28: Mean Values of Time for Commercial Vehicles by Number of Axles

Segment	Value of Time ($/hour)
2-axle trucks	$ 9.95
3-axle trucks	$ 13.48
4-axle trucks	$ 17.80
5-axle trucks	$ 22.95
6-axle trucks	$ 27.73
Average Distance (miles)	63.7

A benefit of MMNL model estimation is that it allows a VOT distribution to be developed for each of the study segments. The VOT distributions for auto travelers were simulated using ten thousand random draws taken from the categorized income distribution for the sample. These draws were then combined with 10,000 independent draws from the log-normal distribution estimated for travel time sensitivity. This results in 10,000 simulated VOTs which can be used to plot the VOT distribution at a given distance. Figure 47 (on the following page) shows the VOT distribution for the I-20 East home-based work segment assuming 20 mile trip distances.

For commercial vehicles, a similar approach was followed. A VOT distribution was simulated for each vehicle size, from two axles to six axles, using the specified number of axles and 10,000 independent draws from the log-normal distribution estimated for travel time sensitivity. The resulting 10,000 simulated VOTs for each vehicle size were used to plot the VOT distribution at a range of distances. Figure 48 shows the VOT distribution for 2-axle trucks traveling a distance of 50 miles.

Figure 47: I-20 E Home-based Work VOT Distribution for a 20 Mile Trip

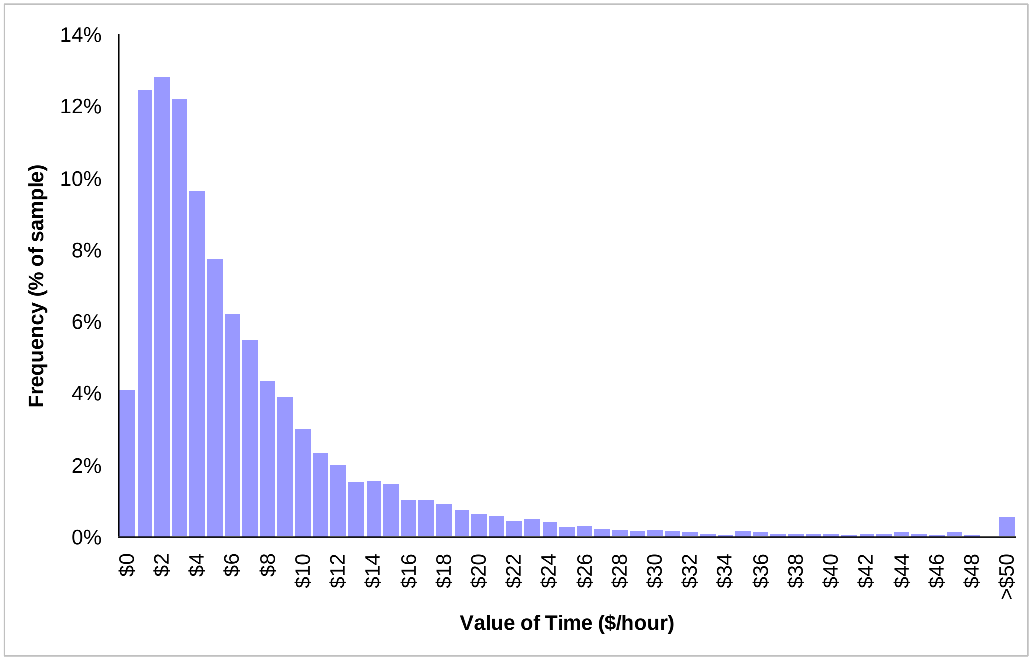
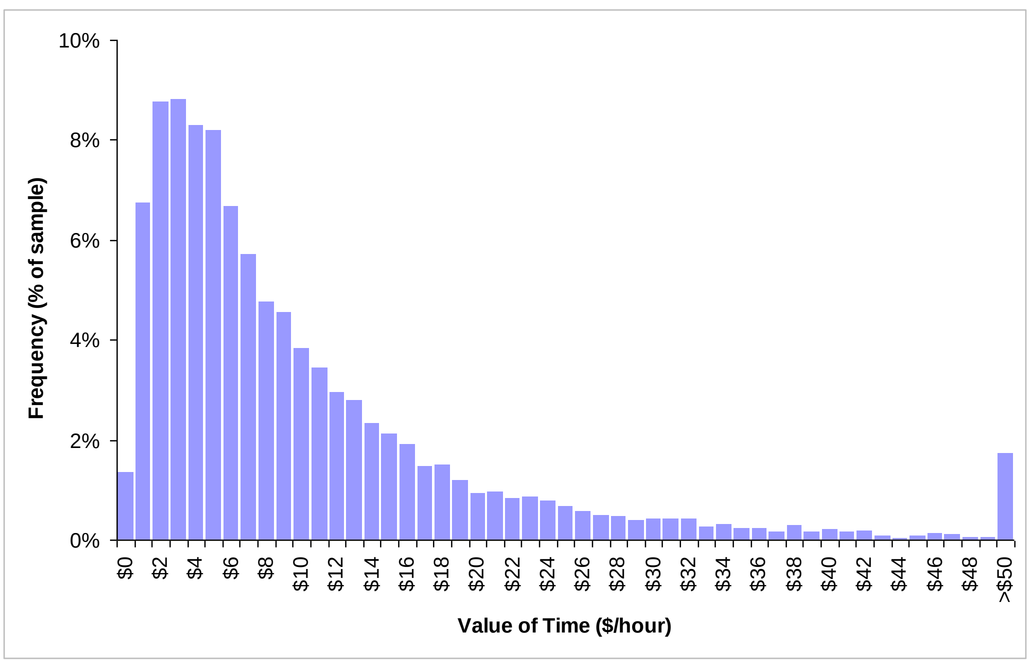


Figure 48: Commercial 2-Axle VOT Distribution for a 50 Mile Trip



The VOT distribution for each segment can also be used to generate a diversion curve for a specified travel distance. The diversion curve indicates the percentage of travelers who would choose a tolled travel option given a certain value of travel time savings. For instance, if the travel time savings provided by a tolled option were valued at $5 per hour, approximately 49% of travelers making a 20 mile trip would use this option. If the travel time savings provided were valued at $10 per hour, roughly 21% of travelers would choose this option.

Diversion curves for trips of 10, 20, 30, and 40 miles for the I-20 East home-based work segment can be seen in Figure 49. The VOT distributions were also used to create diversion curves for each truck type. Diversion curves for trips of 25, 50, 75, and 100 miles for two axle trucks can be seen in Figure 50 (on the following page).

See Appendix I for diversion curves for all auto segments and for trucks with from two to six axles.

Figure 49: I-20 East Home-base Work Diversion Curves

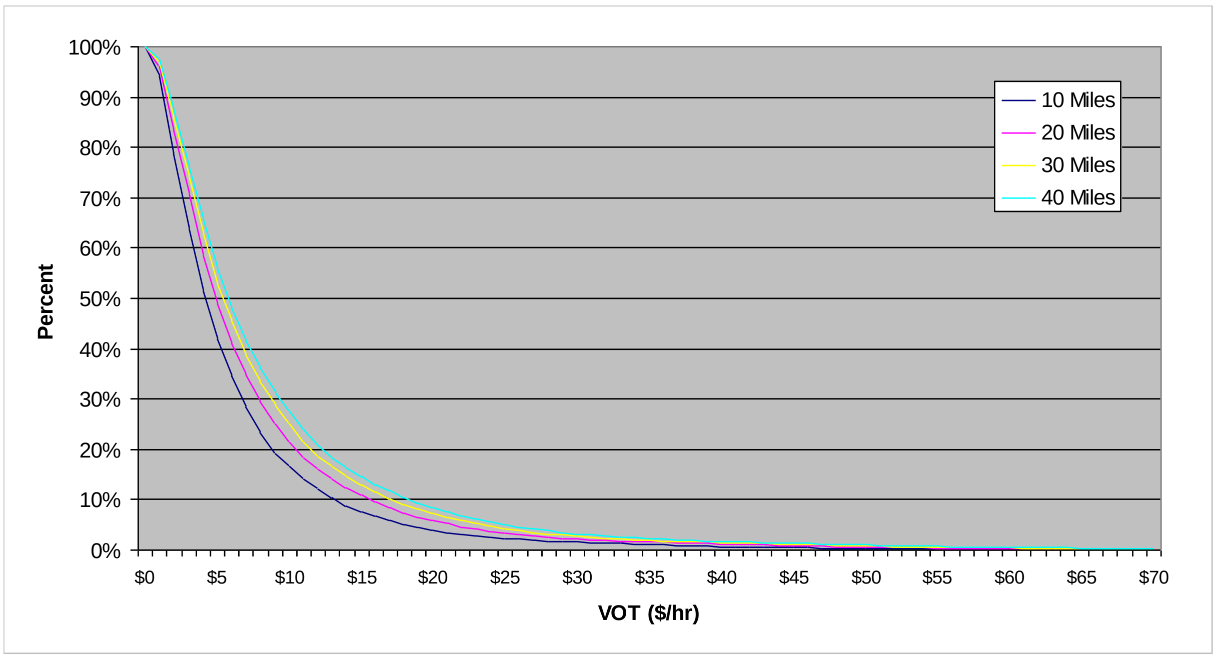


Figure 50: Commercial 2-Axle Diversion Curves